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THE AMERICAN GAS LIGHT JOURNAL

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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

Seventh Annual Meeting, Pacific Coast Gas Association.

OFFICE OF THE SECRETARY, OAKLAND, CAL., June 7, 1899.

The seventh annual convention of the Pacific Coast Gas Association will be held in the city of San Francisco, Cal., on Tuesday and Wednesday, July 18th and 19th, 1899, commencing at 10 A.M. The meeting place will be the office of the San Francisco Gas and Electric Company, No. 413 Post street.

Papers will be contributed by:

"President's Address," by Mr. Charles F. Adams.
"Coal Combustion," by Mr. John L. Howard.
"Electrolytic Trials," by Mr. Wm. A. Aldrich.
"Gas Stoves, from Foundry to Consumer," by Mr. L. Kahn.
"Determinations," by Mr. J. B. Grimwood.
[Title to be announced], by Mr. Oscar B. Weber.
"Experiences," by Mr. F. H. Eichbaum.
"Historical Review," by Mr. W. M. Parker.
"Wrinkle Department," edited by Mr. G. H. Hollidge.
"Experience Department," edited by Mr. John Clements.

An excursion on the Bay of San Francisco, to the Union Iron Works, Mare Island and other points of interest, will be made on Thursday.

The Secretary will be in attendance at headquarters, No. 413 Post street, Tuesday, until 10 P.M., to meet members and afford information.

Queries for "Question Box" should be sent in prior to July 15th for assignment to members. JOHN A. BRITTON, Secretary.

[OFFICIAL NOTICE.]

Special Committees, American Gas Light Association.

Mr. Alfred E. Forstall, Secretary of the American Gas Light Association, forwards us the following list of those appointed on the named special committees to act in connection with the next meeting of the Association:

Committee of Arrangements—Alten S. Miller (chairman), Wm. R. Beal, S. F. Hayward, J. H. Jourdan, J. M. Rusby; and Alex. C. Humphreys and A. E. Forstall, *ex-officio.*

Committee on Nominations—Irvin Butterworth (chairman), R. M. Dixon, K. M. Mitchell, F. C. Sherman and Wm. McDonald.

To Award the Beal Medal—Eugene Vanderpool (chairman), C. H. Nettleton and A. B. Slater.

Finance Committee—George G. Ramsdell (chairman), Rollin Norris and E. H. Jenkins.

BRIEFLY TOLD.

OBITUARY NOTE.—WILLIAM WHITWELL GREENOUGH.—Another veteran American gas man, who in his day and time—and both were long—made an impression on the industry that its history will always retain, passed over when death came to William Whitwell Greenough. Mr. Greenough died at his home, 299 Marlboro street, Boston, the afternoon of the 17th inst., after an illness that was brief. Deceased was in his 81st year, and between 1854 and 1889 he served the Boston Gas Light Company, nominally as its Treasurer, but actually as its moving and maintaining spirit. Under his guidance it grew and prospered, and in the years from 1860 to 1888 it was quoted as one of the model works of America. A safe business man, a studious engineer and of much literary worth, it is not to be wondered at that in his prime mental and physical years he held a central place in the best life of New England's most famous city. This note is intended merely as preliminary to a complete recounting of his career, which is well worthy of extended mention, and time will be required to collate and arrange its

many happenings. He was the first President of the New England Association of Gas Engineers, and served it as such from 1871 to 1875. In the last named year he declined a re-election, being succeeded in office by his warm friend, the late Mr. George D. Cabot, of Lawrence, Mass. He was elected to Honorary Membership in the American Gas Light Association at its sixth annual meeting, New York, October, 1878. A coincidence in this connection was the election then of his son (Mr. M. S. Greenough) to membership in the Association. At that time Mr. M. S. Greenough was to all intent and purpose the Engineer of the Boston Gas Light Company. Always a public spirited man, in a community where very many of his contemporaries were imbued in like way, it is noteworthy that Mr. Greenough, for 32 years (from 1856 to 1888), was President of the Boston Public Library. He is survived by his widow, a daughter and three sons.

THE MEETING OF THE WESTERN GAS ASSOCIATION.—Our despatches of a week ago, respecting the 22d annual meeting of the Western Gas Association, were so complete that small margin is left for further comment on it. One mention was altogether omitted, but neither from design nor the thought that it was not worth chronicling. The omission was in the failure to state that the "Wrinkle Department" had been committed to the custody of Mr. F. H. Shelton, of Philadelphia, and it hardly needs the remark from us to add weight to the fact that a more capable Editor would have been hard to find. The success of the meeting, considering the circumstances connected with its convening—such as the putting forward of the convention time one month and the enforced absence of President Thompson—was phenomenal; but perhaps some if not much of the success sprang from the unanimity of the members in their work to keep things going. It may seem out of place, too, to say that one did more than another respecting the work accomplished by the entertainment committee; but it looks in line with truth to remark that Mr. E. G. Cowdery and Mr. Fred. Bredel left nothing undone that should have been done for the perfect, homelike, sincere and unremitting attention they gave to the Association and its guests.

NOTES.—A correspondent informs us of the death, early this month, of Mr. Cyrus Kingsbury Remington, who had been Secretary of the Mutual Gas Light Company, of Buffalo, N. Y., from the time of its incorporation (about 1870) until its merger with the present consolidated Company. He was in his 70th year, having been born at Tarrytown-on-the-Hudson, N. Y., May 4, 1830.——Mr. F. P. Addicks has resigned the Treasurership of the Boston (Mass.) Gas Light Company to accept the post of General Manager of the Amalgamated Copper Company. His headquarters are in New York city.

Correspondence

[The JOURNAL is not responsible for the opinions expressed by correspondents.]

The Kern Burner and the Kern Incandescent Gas Light Company.

NEW YORK, June 21, 1899.

To the Editors AMERICAN GAS LIGHT JOURNAL:

In the advertisements in the daily papers soliciting subscriptions to the stock of "The Kern Incandescent Gas Light Company," the statement is made that the burner will give 30 to 40 candles per foot of gas, as against 15 to 18 candles by the Welsbach. I presume these figures refer to tests made of the two burners, though I have never before heard of such high results as 40 candles per foot having been obtained with the Kern burner.

If this is the case, I wish to draw attention to Dr. Love's tests with the Welsbach burner, made in 1894, and which were published at that time, wherein he obtained, with New York city gas, results as high as 24 77 candles per foot (averaging 22.75), and even better results have since been obtained with the improved Welsbach burners.

It is difficult to realize wherein any great improvement has been effected by the Kern burner that cannot be duplicated by other means that do not infringe its patented claims, or why so much capital is required for the manufacture of a brass tube and a few pieces of stamped brass work. Better mixture and increased draft and pressure seem hardly the basis for an indefeasible patent claim.

The statement that "The Kern System is equally applicable to power, heating and cooking," if it means anything, must mean that the same economy may be obtained with gas used for these purposes as is claimed for its use compared with the Welsbach; viz., 100 to 122 per cent. increase. This is a very large claim, and some figures in support of the statement would be of interest. Yours truly, INQUIRER.

[OFFICIAL REPORT—REVISED BY THE SECRETARY.]

PROCEEDINGS, TWENTY-SECOND ANNUAL MEETING, WESTERN GAS ASSOCIATION.

HELD AT HOTEL PFISTER, MILWAUKEE, WIS, JUNE 14, 15 AND 16, 1899.

FIRST DAY, WEDNESDAY, JUNE 14—MORNING SESSION.

The Association was called to order, at 10 A.M., of June 14, by the First Vice-President (Mr. I. C. Copley, of Aurora, Ills.), who assumed the Chair on account of the absence, through illness, of the President, Mr. George Treadway Thompson. The regular order having been called for President Copley said, in

INTRODUCING MAYOR ROSE,

I presume you all recognized the fact that when I came in I brought with me a *rose*—the Hon. D. S. Rose, Mayor of Milwaukee, whom some of us may need to know. I have pleasure in introducing Mayor Rose, who has consented to welcome us to the city over which he presides.

THE MAYOR'S WELCOME.

Mayor Rose—Mr. President and Gentlemen of the Convention: It affords me much pleasure, in behalf of the people of our city, to extend a greeting to you. Milwaukee in recent years has become one of the most popular convention cities in the United States, and we take a pardonable pride, I think, in receiving visitors who come from other cities, and in using our best endeavors to make their visits enjoyable and profitable. I can readily understand the great profit that of necessity must result from conventions of this character, in which men engaged in a particular line of business associate and come together for the purpose of discussing those questions that are of paramount importance to the particular business in which they are engaged. We have in Milwaukee a Gas Company, and we have formed a bond of union with that Company. Our relations have in fact become quite cordial; indeed so close have they become that the Gas Company extends to our people, on the first day of every month, an urgent invitation to call upon its managers at their office, which invitation we usually accept. It may be a disclosure to you, gentlemen, of information which you do not now possess when I say to you that Milwaukee produces natural gas—in prolific quantities; but there is a difference between gas—and gas. If you associate with my friend Cowdery during your visit in our city you will have an opportunity to test both samples of gas! (Laughter.) We have a population of about 300,000. We have nearly 4,000 manufacturing industries, and our output last year exceeded $147,000,000; so that as a manufacturing city we claim a place upon the map. It is our aim to keep step with our sister cities in the pathway of progress, and we claim that we have in our population as much energy, industry, frugality and enterprise as has any other city in this Union. A very large percentage of our people own their own homes, and we take pride in the mild sort of rivalry among our people in the efforts to make each individual home more attractive and pleasant than its neighbor. As a result we have one of the most beautiful residential cities in the United States. I think you will bear me out in that statement when you have had opportunity to look over Milwaukee. We take pride in our public institutions. Within the last ten years Milwaukee has spent an enormous amount of money in building up our public institutions. We have an educational system which is the peer of any system in any State of the Union. Our schoolhouses are of the most improved and attractive order. Our public library was erected within the last few years at an expense of three quarters of a million of dollars, and that library, with our museum, compares favorably with any other institution of a similar character in the whole country. Our city hall, erected at an expense exceeding $1,000,000, is one of the nicest, most commodious and attractive office buildings of that kind in this country. We have here a system of drainage that is incomparable; a drainage tunnel connecting the Lake with the river, through which the river is flushed every 24 hours, thus insuring healthfulness to our people. Now we are in the act of constructing another tunnel for the purpose of flushing one of the other rivers, upon the south side. Our park system is new, but we have a number of very attractive young parks that will be inviting to you gentlemen if you desire to take a breath of fresh air upon the shores of Lake Michigan. It has been charged that under this administration we have been running a "wide-open" town. For fear that my political adversaries may feel disappointed, I say to you, gentlemen, that the town shall be "wide open" to you during your stay in our city. (Applause.) If you chance to find any place closed

against you, call out the police department to open it for you. (Applause.) I commend you for your most excellent judgment manifested in selecting Milwaukee for this annual gathering of your Association, and if you exercise the same judgment in the future we shall expect to greet you annually hereafter as our guests in the city of Milwaukee.

I thank you for the attention you have given me, and I extend to you all a most cordial and most heartfelt welcome. (Applause.)

Mr. Doty's Response to the Mayor's Welcome.

The President—We are all moved by the spirit of true appreciation for the graciousness of Mayor Rose, but as we cannot express it to him individually, because it would take too much of our time, and because some of us could not tell it to him as well as we would like, it will, therefore, perhaps, be best to select Mr. Paul Doty, of Grand Rapids, Mich., to express for us those sentiments which we all share.

Mr. Doty—Mr. Mayor and Gentlemen of the Association: When, at our meeting in Detroit last year, we decided to come to Milwaukee this year, I am sure we were all glad, because we knew of the open-hearted and cordial hospitality which has made Milwaukee famous; and we know Milwaukee is famous because Schlitz has said it is famous. Mr. Mayor, these gentlemen are members of the Western Gas Association; but practically it is Western only in name. While it is not a National Association, it is more than a local Association; it is an Inter-State Association, and you see here men from the East—my former home—men from the South, as far as Texas, and men from the Middle as well as from the far Western States. These men are not the gas magnates. They are not the capitalists. They are the men "behind the guns." These men do the work and bring about the results which make gas securities to-day a profitable investment. I was very glad indeed to hear you give expression to the cordial relations which exist between the municipality and gas corporation of Milwaukee. There is no question that the stability of a gas company depends upon the feeling of the people toward the company, and Milwaukee is fortunate in having such representative men associated with its Gas Company. When men like Mr. Bigelow, Mr. Beckey, Mr. Weil and Mr. Payne—men whom you respect in all the walks of life—identify themselves with a gas company, and lend their names to that company, you can be assured that the interests of the gas company and of the city are mutual. Such men would not lend their names to an association or to a company which did not have for its object the welfare of the city. Unquestionably the prosperity of a gas company is limited by the prosperity of the city. The gas company is peculiarly a local institution. We cannot sell our product outside of the limits of the city or outside of the limits of our mains; and as the city is prosperous the gas company prospers. It is bound to be so, for the relations are indissoluble. I was surprised and pleased to hear that Milwaukee has 300,000 people. I believe it by looking at the multitudes on the streets. Gas companies estimate their progress upon the basis of population. For instance, if we want to know how well a company is doing we are apt to base our comparison on the per capita consumption of gas. The earnings per capita also show the worth of the gas company. While we knew that Milwaukee stood at the head of the list of the companies, it was not 300,000 population that we had in mind. I am glad it is not. Grand Rapids was a close second to Milwaukee in matter of comparison, and I think if Milwaukee had been rated at 300,000 Grand Rapids would have been at the top of the heap. I am glad to know that the educational system of Milwaukee is so prominent. The success of gas companies must depend upon the enlightenment of the community. An educated people will use gas; an uneducated people will not use it. The greater the education the more prosperous will be the gas company. You speak of Milwaukee being a "wide-open" town. Grand Rapids is also a "wide-open" town. Our Mayor, Mr. Perry, was elected last year upon a "wide-open" platform. "Wide-open," not in the sense of license, but in the sense of personal liberty. I have pleasure in expressing the opinion that the Western Gas Association is a "wide-open" Association. We meet to disseminate information and to exchange experiences—the fraternal spirit, I think, is one of the prominent characteristics of the Western Association. The members are really brothers; and in view of the fact that this is a "wide-open" Association I think it would be well for us to extend a brevet membership to Mayor Rose. We shall be glad to have him come into our wide-open arms. Mr. Mayor, we, who are your guests, salute you. (Applause.)

The reading of the minutes of the last meeting having been dispensed with, the President said: Next in order is the President's address. Preliminary to the reading of that adddress (which was prepared by President Thompson himself) I wish to read a letter from him. While it contains the regrettable news that he will not be with us, it also conveys other news that I am sure every man in this room will be glad to hear. It is a personal letter, but I take the liberty of reading it:

Denver, Col., June 6th, 1899.

I. C. Copley, Esq., Gas Company, Aurora, Ills.:

My dear Mr. Copley: In requesting you to present in my absence the accompanying address to the Western Gas Association it is with sincerest regret and deepest disappointment that I am unable to be present myself. In explanation of my absence, and as a sort of official statement of my condition, I would be glad to have you say to any of the gentlemen who may inquire, that I remain away not because I am in poorer health, but because I am improving at a gratifying rate, and dare not jeopardize the headway already gained by the fatigue and excitement of the convention week. It is the first Western meeting that I have missed in 13 years, and is naturally the one at which I have been most anxious to be present.

With remembrance to any who may inquire, I am, yours sincerely,

Geo. Treadway Thompson, President.

First Vice-President McDonald took the chair, and President Copley read the following

PRESIDENTIAL ADDRESS.

Gentlemen of the Western Gas Association:

It is with deepest pride that I welcome you to this twenty-second annual convention of our organization—pride in the strong and representative body of gas men who are here gathered and in the Association which has convened them, and personal pride in and appreciation of the honor you have conferred in electing me to preside over such a meeting.

We meet this year in a city that is new to many of us, and in which there is much to be seen that is novel and valuable to those of our calling. Its gas works, which all should visit, was the first of its then size in this country to adopt mechanical discharges in the retort house, and is one of the most elaborately equipped for the conveying of materials, residuals and waste products. It was one of the first, if not the first, to adopt the principle of slow speed of passage for gas during purification by the use of two large purifiers, in preference to three or four of smaller area. Its residual plant works up a number of products not usually made at American gas works, and in many other features the equipment is unusually complete. But it is as an object lesson in the marvelous possibilities of gas for fuel that Milwaukee stands pre-eminent. Not only for the more familiar domestic and manufacturing purposes has the field been covered, but new uses have been found and previously unsuspected opportunities seized, until the ratio of gas output of July to that of December is as 1 to 1¼, and the day sendout throughout 8 months of the year more than equals the night output; while on the average of the entire year the output during the 12 hours of night has exceeded that of the 12 hours of daylight by only 3 per cent. of the annual sendout, and the business is still increasing.

There is probably no more difficult task laid upon a gas man than the preparation of the Presidential address for one of his Association meetings. Reviews of the industry and comments upon current conditions are the usual strongholds of such addresses, and are always timely and often decidedly necessary; but the number of such reviews at home and abroad has now become so considerable that it has seemed to me we can with advantage discuss instead the affairs of our own Association, and leave the detailed account of technical advancement and commercial conditions to be brought out by our paper writers and in the discussions.

Our Association, from small beginnings, has had a steady and healthy growth, until to-day it occupies an enviable position in point of size, activity and value to its members. We must not rest satisfied with past accomplishments, however, nor ignore present shortcomings, if we wish to hold our place among the active workers of our profession. I, therefore, ask you to consider with me three questions, "What do we lack?" "Why do we lack it?" "How can we secure it?"

"What do we lack?" Members? Yes. Active members? Decidedly, yes; active in the full sense of the word, whether active or associate on the list, for there is now no essential difference between these classes. We should have a member on our list from every gas enterprise within our borders; an Association's value is not alone in the character of the work it does, but in the number whom it reaches. Why is not ours completely representative of our territory?

Conversations with the managing officers of a number of gas companies not represented in our membership have brought out several reasons for their declining to join us. One President told me he had been present at one meeting, and found more attention given to pleas-

ure than to business, so he resolved not to let any of his men go. Another said that for three years he sent his Superintendent to this Association's conventions; but on returning his whole talk was of the fine time at the banquet and excursion and the good stories he had heard. Still another gentleman, a Superintendent, stated that at the meeting at which he was present, he seemed to be expected to give more information than he received.

Probably the greatest reason for our not having on our rolls one man at least from every company in our district is that most of the plants not now represented are small ones, owned locally by men who do not know our work and worth, and superintended by men whose salaries do not permit the expense of attending an annual meeting. But while we are thus remarking upon such outside companies, let us not forget that many of our own number pay their expenses to these meetings. Do we begrudge the money? No; but we want to make the advantages, the benefits, the value of the Western Gas Association so recognized that the "powers that be" in every company will not say, "We cannot afford to pay our superintendent's expenses," but "We cannot afford to have him stay away."

Almost without exception the works of the non-member can be told at a glance. The secretary or superintendent is often a little afraid of visitors—they may learn something from him, so he hesitates to show them about. Perhaps this is in compliance with orders, but the results are the same, for the visiting gas man has no opportunity to suggest the adjustment here and the wrinkle there, or to compare notes on how *he* does things. The free interchange of experience is such a benefit and pleasure to us that we can scarcely understand the nature which repels such advances or refuses to reciprocate.

By this I do not mean to say for a moment that membership in an Association insures a neat and well-ordered plant, or that the non-member cannot hope to compare or compete. I have seen works, operated by men who are highly regarded as Association members, in which reigned disrepair, disorder and inefficiency. I have visited other plants under the care of men not identified with any Association, whose neatness and order it was a pleasure to see. Each of these it is fair to say was a somewhat exceptional case, and the point I desire to emphasize is that our organizations have tended to open the doors of our works to one another, and that, in addition to learning from one's visitors, we are apt to be more critical of our own plants when they are present, and to see the leak here and the dirt there, which we may have passed by a dozen times before unobserved. It is a pretty good rule to go about your own works at all times in the attitude of a visitor.

We agree, then, that one of our needs is to be more thoroughly identified with the individual companies in our section. How shall we secure the additional members which this requires?

In former times we have been content to grow in much the same fashion as our business itself grew not many years since. We welcomed those who came to us, but made little effort to induce others to join.

This year we have undertaken systematic work in recruiting, and a National Committee was appointed last July, with a sub-committee for each State. The earnest efforts of the gentlemen who compose this combined committee will doubtless result in a large accession to our membership. Realizing, however, that much missionary work has been done without tangible result as yet, I recommend that this committee, strengthened by such changes as experience may have suggested, be continued at least another year.

Again, what do we lack? A greater interest in the work? Yes; or perhaps I should say a greater *evidence* of interest. That an interest exists is shown by the roll call; but is it reflected in the papers and debates, as indicated by the number who participate? Let us see.

Here is a table giving the figures for the past three conventions. In the absence of exact data it is assumed that all new members at each meeting were present; and the numbers given as having joined in the discussions are in addition to the paper writers, who of course were also heard in the debates.

Year.	Members	Attendance.		Participants.				Per Cent. of Attendance.	Per Cent. of Membership.
		No.	Per Ct.	Papers.	Wrinkles	Debate.	Total.		
1896	292	107	36.6	7	13	12	32	30.0	10.9
1897	287	130	45.3	8	9	20	37	28.5	12.9
1898	299	153	51.2	9	12	19	40	26.1	13.0

It is evident from these figures that our chief lack is not in the proportion of attendance, especially when we remember that each year there are additions to our associate membership of gentlemen who do not again attend until we revisit their city. A comparison of the attendance of active members alone would give a still higher percentage. Another thing shown is the large increase in participants through the Wrinkle Department.

One of the things *not* shown by the table is the proportion of those in actual attendance at the conventions' several sessions. It is well recognized by our Arrangement Committees that the capacity of a meeting hall is seldom taxed except at the opening session. We have a few writers and speakers who can secure and hold the general attention; but, as a rule, it is the "old guard" alone who withstand outer attractions.

The more important matter not shown by the table, but most apparent when preparing it, is that the participants in authorship and debate include the same names year after year. This is a more serious matter than the small proportion of those who take part. It means that less than 15 per cent. of our members are carrying most of the load, and that the rest aid only with their dues and not with their doings. This is unfortunately true of almost all Associations like ours; but there are enough exceptions to encourage us in an endeavor to improve the conditions in our own case. The notable exceptions are in smaller bodies, it is true, whose members are less scattered as to territory, and are, therefore, more closely acquainted.

It is a standing argument in favor of attendance at our conventions that the conversations between sessions are quite as valuable as the published proceedings. It cannot be a lack of information or of experience, then, that prevents more general participation in discussions. Is it diffidence? No doubt, to some extent, for many of us are unaccustomed to speaking before an audience, and others from small works may hesitate to express their views or detail their experiences, lest to the engineer or manager of the greater companies these matters may seem petty. To the first of these it may be said that the auditors in convention are the same to whom one would speak freely "down stairs," and are merely a larger group, but equally in sympathy; the latter class should remember that in a large company the work is necessarily so specialized that few have the broad knowledge of the business as a whole that is possessed by the man from the small works. No man who has an item to add to a discussion, or a question to ask concerning its subject, should hesitate from any such considerations as these. The additional contributions to the debate will be warmly welcomed.

In this connection it has occurred to me that perhaps some of the papers may seem a little over the heads of many of us, and that this partly explains our silence. This Western Association, however, has always been eminently practical in the character of its subjects for discussion, and has introduced little that we cannot reach and apply. We *must* maintain a high standard if we are to justify our position, and unless we have an occasional lesson that is a little beyond us we cannot grow as we should. Yet there are some of us who would be glad of discussions more elementary, and to these I cannot too highly recommend the work of the Practical Class, instituted by a sister Association, but now supported by voluntary subscriptions as an independent undertaking.

Our greatest need, then, is that our members take part in our proceedings to a greater extent than by passive presence at the conventions. A large and attentive audience is a deserved encouragement to one who has given time and study to the preparation of a paper, but we have long considered that an active discussion is the chief tribute to its excellence. Such a discussion can only be properly secured by designating in advance those whom we wish to take part, and providing them before the meeting with copies of the paper. This has been done to a greater or less extent for several years, and we have endeavored to accomplish it more thoroughly than ever for this meeting. The greatest difficulty met with in carrying it out lies in the fact that the papers are often so late in reaching the Secretary that by the time they are printed but a few days remain before the convention. Even with a month more time this year the same difficulty has arisen. Personal appeal to the writers is about the only recourse, and this is too often unavailing. We may be justified in considering the rejection of papers which are not in the Secretary's hands, say three weeks in advance of the meeting; but we must not forget that we would thereby encounter a too-prevalent trait of human nature, the "eleventh hour habit," which might deprive us of much desired contributions. Witness the rush in our offices each month on the last discount day. If we could not enforce such a rule we are better without it.

The Wrinkle Department has been the greatest factor in late years in increasing the number who contribute to our transactions, and if this were its only claim it has justified its continuance.

Among other efforts to increase the individual participation in our work it may be mentioned that, in appointing the Membership Committee, preference was given to those gentlemen from whom we do not often hear in authorship or debate. Again, in advance of the meeting of our Executive Committee at which our programme was arranged, I wrote to some 20 of our members the question, "What subject would you like to have discussed at our convention?" Most of the suggestions received have been incorporated in papers or in the Question Box, and it is hoped that the gentlemen who offered these subjects will give us the benefit of their own opinions upon them.

Unfortunately this shortcoming which we are considering cannot be remedied by presidential recommendations or committee reports. The foregoing discussion is but a general suggestion, and I can only supplement it by appealing to each individual member to do his part in adding to the general fund of experience, and to be assured that his aid will be heartily appreciated. These words, the discussion of our needs and opportunities, are by no means written in a spirit of censure, nor are they intended as a sermon. They are plain, blunt statements of facts and conditions which we realize, and must recognize. To this list it is but fair to add that we do *not* lack the most essential of all conditions to successful association, loyalty and harmony. Assured of these by the years that have passed, we may be certain of the ultimate accomplishment of all our aims.

In the Wrinkle Department of 1896, the following paragraph appeared:

"In addition to the office of the Wrinkle Department in supplementing the Question Box, as was prophesied for it at its institution, the thought occurs to the Editor that it has a work to do as a 'Suggestion Box.' In our idle moments do we not often think of devices which we will sometime work out, which are mayhap of little immediate use, but might be convenient under certain circumstances later? Upon some of these ideas we may have already worked in a desultory way, but not being altogether satisfied with our progress, while the object sought is not sufficiently vital to arouse our determination to solve it ourselves, we may be willing to outline the end to be accomplished, and let our brethren have a shy at it."

In the three years which have elapsed since this was written, nothing has been done to put the suggestion into effect. I, therefore, bring it once more to your attention, to act upon if you deem it of possible value. A number of directions to which experiments and ingenuity might be devoted were mentioned in the paragraph following the one just quoted, and many others will occur to us. The suggestions might be made during the convention, or sent to the Secretary in the interval between meetings. He could then notify the members by mail, or by a notice in our official organ, and the fruits of our research on the lines suggested would be presented at the following meeting.

The election of officers by open ballot instead of by nominating committee has now been in use long enough to be considered a decided improvement, but I happen to know that the method as recommended by President Littleton contemplated one feature which we have never followed. It was that *no nominations were to be made.* The first ballot would show the candidates, and while it is to be expected that the two Vice-Presidents in their order would be advanced, since they thus become familiar with the work before assuming the chair, in the case of the new Second Vice-President and of the four Directors a greater latitude in selection is possible by this method than if formal nominations are made.

In order that the effect of this plan may be determined, I recommend that at the election to-night no nominations be made, but that the voting for each office be confined to the candidates whose names appear on the first ballot in each case.

Among the committees appointed last year was that to whom was entrusted the publication of our proceedings. Circumstances compelled the resignation of the chairman of that committee, and in his place Mr. O. O. Thwing was appointed, who has arranged for the publication at materially less cost than our original estimate. Unavoidable delays have prevented the fulfilment of our original plan of distributing these books at this meeting, but I am assured that they will be mailed to the members within the next month. This publication of our proceedings is a decided step forward, and an important factor in insuring our recognition as an active and important Association. Valuable as are the reports published in our official organ, they are there lost sight of to most of us, while in book form there is a strength and coherency in the evidence of our work which cannot fail to be recognized.

During the past year our ranks have again been invaded by death. Mr. H. C. Bolcom, of Winona, Minn., died Feb. 11th, 1899; and Mr. B. P. Holmes, of Youngstown, Ohio, was stricken Feb. 13th, 1899. Mr. Bolcom joined our Association in 1888, and was seldom absent from our meetings. Mr. Holmes first met with us in 1896, and also attended the conventions regularly. Mr. Holmes was President of the Ohio Gas Light Association, and an expression of our sympathy was sent them at their recent meeting. Both gentlemen enjoyed a wide acquaintance and will be sorely missed. The Committee on Memorials will take suitable action regarding their decease.

When we met in Detroit a year ago our country was at war with a foreign power; and however sanguine we may have been as to the final triumph of American arms, we could not fail to realize what the conflict must mean in its cost to our patriots and our treasury. To-day we have counted that cost; and, long as is the roster of those who will answer no more an earthly roll call, our Nation has conquered, peace reigns, and a tide of prosperity has followed, affecting our industry no less than others. In these recent months our Nation has taken a long step forward in her mission of enlightening dark places of the earth. May we keep pace with her growth, and, by our continuing successes in fulfillment of our watchword "Let there be light," reflect every credit upon our Association, the companies we represent, and this grand republic, our Country.

APPOINTMENT OF COMMITTEE ON PRESIDENT'S ADDRESS.

The Chairman—You have listened to this very interesting address of our President. Assuming that, in the usual course, it will go to a committee for consideration and report, if there is no objection I will appoint as such committee Messrs. C. H. Dunbar, H. Wilkemeyer and J. J. Knight.

President Copley resumed the Chair and announced the appointment of the following

SPECIAL COMMITTEES.

Committee of Arrangements for Current Meeting—E. G. Cowdery, S. J. Glass and Fred. Bredel, Milwaukee; A. B. Eaton, Chicago; C. H. Dickey, Baltimore, Md.; H. D. Harper, Chicago; Geo. D. Roper, Rockford, Ills.; H. L. Doherty, Madison, Wis.; Paul Doty, Grand Rapids, Mich.

Auditing Committee—Irvin Butterworth, James Forbes, C. H. Evans.

Applications for Membership—C. R. Faben, T. D. Miller, Eugene Printz.

Introduction of Visitors—J. B. Howard, A. D. Cressler, F. R. Persons, Geo. D. Roper, John Dell.

Publication of Proceedings—Geo. Treadway Thompson, Wm. McDonald, Alten S. Miller, O. O. Thwing.

Memorials—T. C. Jones, James Ferrier, James W. Murdock.

Place of Next Meeting—James Somerville, H. D. Harper, H. W. Douglas, N. A. McClary, Geo. McLean.

Final Resolutions—Donald McDonald, John Gimper, H. S. Whipple.

The President called for the

REPORT OF THE BOARD OF DIRECTORS,

which Secretary Dunbar read as follows:

The annual meeting of the Board of Directors of the Western Gas Association was held at 2 P. M., Tuesday, June 13th, 1899, and, in absence of the President, Mr. Geo. Treadway Thompson, was called to order by First Vice-President, Mr. I. C. Copley. The following members of the Board were present:

I. C. Copley, Aurora, Ills.; Wm. McDonald, Albany, N.Y.; Howard C. Slater, Milwaukee, Wis.; I. Butterworth, Columbus, O.; James Forbes, Chattanooga, Tenn.; Jas. T. Lynn, Detroit, Mich.; Thos. D. Miller, Dallas, Tex; Jas. W. Dunbar, New Albany, Ind.

On motion of Mr. Thos. D. Miller, the following papers were accepted for presentation to the Association:

"Wrinkle Department," edited by Mr. E. H. Jenkins.

"The Causes Underlying the Formation of Naphthalene," by Mr. Paul Doty.

"Problems in New Business," by Mr. F. B. Wheeler.

"Distribution of Gas Under Higher Pressures," by Mr. F. H. Shelton.

"Cyanides in the Gas and Waste Products at Columbus, O.," by Mr. E. E. Eysenbach.

"Isolated Generators for Bench Firing," by Messrs. F. Bredel and W. E. Steinwedell.

"Vitrified Clay Pipes Instead of Iron for Gas Mains," by Mr. Irvin Butterworth.

On motion of Mr. Miller, Mr. E. G. Cowdery was instructed to furnish the local press any information contained in the papers to be presented to the Association.

On motion of Mr. Lynn, seconded by Mr. Slater, it was unanimously

carried that the Board recommend to the Association that Mr. Fred. Bredel be transferred from associate to active membership.

A communication was read from Mr. Alex. C. Humphreys, of the Trustees of the Educational Fund, American Gas Light Association, setting forth the objects aimed for and the result so far obtained by the Trustees; also stating that the Western Association might possibly be glad to co-operate in the work.

In the same connection a letter was read from Mr. Alfred E. Forstall, Secretary American Gas Light Association, giving a memorandum in relation to the work by the Practical Class. After considerable discussion regarding the merit of the work being accomplished, it was voted, on motion of Mr. McDonald, seconded by Mr. Slater, that the Board of Directors recommend the appropriation of $100 for 5 years to aid the Trustees of the Educational Fund in their work.

On motion of Mr. Lynn, seconded by Mr. Forbes, the Board of Directors resolved that the Association be requested to appoint a committee for the purpose of aiding the Spokane Gas Company in prosecuting their suit against the Street Railway Company for destruction of pipe by electrolysis, and for the purpose of publishing and distributing the proceedings, and the decision respecting the case.

The President having appointed the Special Committees on "Auditing," "Applications for Membership" and "Introduction of Visitors," the Board voted to recommend that the Committee on "Publication of proceedings" be continued in their work.

Secretary and Treasurer Dunbar submitted the following report:

TREASURER'S REPORT.

Receipts—

To membership fees	$300 00	
Annual dues	1,075 19	
Sale of badges	31 50	
Advance membership fee	70 00	
Balance, cash on hand May 1, 1898	833 01	
		$2,309 70

Disbursements—

By Secretary's salary	$400 00	
Sundry bills, as per vouchers	689 53	
Balance, cash on hand	1,220 17	
		$2,309 70

SECRETARY'S REPORT.

Membership, May 1, 1898	267	
New members admitted, 21st annual meeting	32	
		299
Dropped for non-payment of dues	2	
Resigned	6	
Deceased	2	
		10
Membership May 1, 1899		289
Badges on hand May 1, 1898	9	
Purchased, Nov. 14, 1898	30	
		39
Sold during the year	9	
		30

There being no other business, the Board adjourned.

J. W. DUNBAR, Secretary.

The report of the Board of Directors was received and ordered placed on file. At the suggestion of the President its recommendations were discussed separately and thus acted upon. The recommendation to transfer Mr. Fred Bredel from associate to active membership was adopted. The proposition to subscribe $100 per annum for 5 years to the Educational Fund of the American Gas Light Association brought out the following discussion:

Mr. Jenkins—I move the adoption of that part of the report.

The President—Is there any discussion upon the matter?

Mr. H. C. Slater—I will mention in this connection that at present only members of the American Association can recommend members to the Practical Class. Members of the Western Association cannot endorse a young man to become a member of that Class at present unless he is also a member of the American Association. In case we make a contribution to the fund I suppose we shall then have the right to recommend members for the Class?

The Secretary—Our receipts are now averaging about $400 per year more than the expenses. The publication of our proceedings (which will soon be due) will cost about $700 for the three years, or $600 for 600 volumes; and we now have enough money ahead to go back with the publication a further three years. I have no doubt that the increased income from the numbers who are joining us will so add to our net revenue that there will be no difficulty in the Western Association being able to pay $100 per year for 5 years to the Trustees of the fund for the Practical Class. I do not think the payment will in any way interfere with our work as we have mapped it out.

Mr. T. D. Miller—I understand the communication from the American Gas Light Association indicates that the members of this Association will, by virtue of such membership, be eligible to recommend members to that Class, but that the action of the American Association will be necessary to carry that recommendation into effect. I would, therefore, like to amend the motion by providing that we make this subscription on the condition that members of the Western Association become eligible to recommend members for that Class.

Mr. Jenkins—I hardly think that is necessary, because the moment this Association subscribes to that fund we are then one of the company, the same as any other company in the United States and anyone of us—not necessarily members of the American Association—can recommend anybody else for that Class. I make that statement because I happen to be a member of the Board of the American Association and know it is thoroughly understood by them in that way. It will not be necessary to put in that proviso, for I assure you that will be the case.

The discussion was closed, and the ballot resulted in favor of making the subscription. The next recommendation was in the matter of aiding the Spokane (Wash.) Gas Light Company in its suit against the local electric railroad company, etc. The debate on this proposition was:

Mr. Howard—Are any other companies as deeply interested as Spokane in that regard?

The President—The sentiment of the Board of Directors was that this should be done without expense to the Association itself, and that a committee should be appointed who would have the authority of the Association to render such assistance as it might deem advisable and proper. It would seem well to extend that assistance to other companies.

Mr. Howard—As I have in mind another company that may commence such a suit, I wanted to know whether those companies that had already commenced suits would come in under that same order of things.

On motion of Mr. Runner the President was directed to name a committee to carry out the recommendation of the Board. On motion of Mr. Montgomery, the recommendation of the Board that the committee on Publication of Proceedings be directed to continue their work was adopted.

The President called for the

REPORT OF THE COMMITTEE ON APPLICATIONS FOR MEMBERSHIP,

which Mr. Persons read as follows:

Your Committe recommend the election of the following members:

From Associate to Active.

Bredel, Fred., Milwaukee, Wis.

Active.

Andres, J. F., Belleville, Ills.
Averill, G. M., Cedar Rapids, Ia.
Bippus, J. F., Huntington, Ind.
Bowen, F. W., Kenosha, Wis.
Becker, N., Chicago, Ills.
Capron, H. S., Princeton, Ills.
Cooke, A. S., Lockport, N. Y.
Chubbuck, H. E., Quincy, Ills.
Christie, C. H., Peoria, Ills.
Dunham, J. C., Montgomery, Ala.
Danforth, G. L., Decatur, Ills.
Diall, M. N., Terre Haute, Ind.
Eustace, J. H., Chicago, Ills.
Farrel, J. H., Wausau, Wis.
Fries, Fred., San Antonio, Tex.
Frazer, D. H., Battle Creek, Mich.
Gillett, M. M., Newark, O.
Goldsmith, W. G., B. Harbor, Mich.
Gerould, C. L., Galesburg, Ills.
Highlands, E. M., Clinton, Ia.
Johnston, J. O., Columbus, O.
Jones, C. D., Independence, Ia.
Kincaid, H. C., Jackson, Tenn.
Kellogg, L. L., Sioux City, Ia.
Keffer, W. B., DesMoines, Ia.
Martin, F. M., Taylorsville, Ills.
Malone, M. E., Madison, Wis.
Mainland, Wm., Oshkosh, Wis.
Mayers, J. A., Columbus, O.
Nutting, C. H., Chicopee, Mass.
Olds, H. L., Lincoln, Ills.
Palmer, L. T., Leavenworth, Kas.
Paullin, W. C., Col. Springs, Col.
Riselay, W. S., Buffalo, N. Y.
Sombart, W. E., Boonville, Mo.
Spencer, F. S., Monmouth, Ills.
Steinwedell, W. E., Quincy, Ills.
Stephens, H. H., Macomb, Ills.
Searle, R. M., Atlanta, Ga.
Templeton, E. S., Greenville, Pa.
Tuffs, J. H., Syracuse, N. Y.
Tippey, B. O., Detroit, Mich.
Warmington, G. H., Cleveland, O.
Winslow, W. H., West Superior, Wis.
Walker, L. E., Lansing, Mich.
Walker, E. M., Hyde Park, Mass.
Wheeler, F.B., Binghamton, N. Y.

Associate.

Blount, C. F., Detroit, Mich. Johnston, E. D., Connersville, Ind.
Buckley, J. C., Chicago, Ills. McDonald, D., Albany, N. Y.
Callenbach, J. A., Milwaukee, Wis. Platt, E. S., St. Louis, Mo.
Henry, W. G., Chicago, Ills. Williams, T. C., Evanston, Ills.
Hoagland, E. H., Chicago, Ills.

ELECTION OF NEW MEMBERS.

On motion of the Secretary Mr. William McDonald was instructed to cast the ballot of the Association for the election of the above-named to membership.

Mr. McDonald subsequently reported that in accordance with the instructions he had deposited the ballot of the Association in the manner directed.

The President, having declared the election of the several applicants, asked those in attendance to rise.

Mr. Howard—Mr. President and Gentlemen of the Association: It gives me great pleasure to introduce to you the gentlemen who have now become members of our Association. I am gratified to be able to state that no body of men ever presented to this Association have exceeded those now presented, either in handsome features, beauty or real worth. I will also state to the new members that, while they are new, they must feel that they are just as much entitled as the older members to enter into any of the discussions that may come up or be brought out by the reading of papers. I hope they will all feel free to take part in any of the proceedings.

The President—As President of the Association I heartily welcome you to membership with us, and hope you will take active part with us in the proceedings of this meeting.

TELEGRAM TO PRESIDENT THOMPSON.

On motion of Mr. Doty the Secretary was instructed to send a telegram to Mr. George Treadway Thompson expressing the formal sentiment of the Association of their regret at his not being present at this meeting, and an earnest hope for his speedy recovery of health.

The President then introduced Mr. Paul Doty, of Grand Rapids, Mich., who read the following paper on

THE CAUSES UNDERLYING THE FORMATION OF NAPHTHALENE AND THEIR PREVENTION.

It will be admitted the subject of naphthalene is trite by title. The fact remains, however, that naphthalene, like the poor, is always with us. Reports from a variety of sources indicate the naphthalene trouble was unusually prevalent this past winter. Not only were coal gas plants afflicted, but companies making carbureted water gas exclusively had bitter experiences; fortunately for ourselves, although subject to the contagion, we escaped the fever.

Our President reminds me that, outside the paper presented by Mr. K. M. Mitchell, at the Old Point meeting of the American Gas Light Association in 1897, the subject has been dormant for years. Our cousins across the water have been more active in leading the way, and really Mr. Mitchell's paper was an outgrowth of the paper presented by Mr. Shadbolt at the meeting of the Eastern Counties Gas Managers' Association in 1896.

Mr. Shadbolt's invention refers chiefly to a method of self-enrichment of coal gas, and incidentally, as shown by Mr. Mitchell, the prevention of the deposit of naphthalene is accomplished. There exists at present a variety of opinions as to the value of the Shadbolt process. This is to be regretted. Our own experience in returning a portion of the scrubbed gas to the inlet of the exhauster gives variable results. We are not, therefore, in a position to affirm or deny the merit of the process, and for the present suspend judgment. Certain it is the method is simple of application, and no possible harm can come from its use, so that if the necessity for its trial by reason of naphthalene stoppages exists, let those who desire try it. We are not now continuing our experiments, for, as stated above, we escaped the fever.

It should be stated the Shadbolt invention is patented, Mr. Mitchell says, in England. I have not learned whether there is an American patent.

Besides the Shadbolt method, the "Hastings Carburation Process" had invited the attention of English engineers. This process had avowedly a different purpose than self-enrichment, for, at the 1898 meeting of the Southern District Association of Gas Engineers and Managers, Mr. C. E. Botley (Hastings) read a paper describing an "Extended Experience with the Hastings Carburation Process for the Prevention of Napthalene Deposits in the Distribution Mains and Services." Previous to this, in 1897, Mr. Botley read a paper on this subject before the Institution of Gas Engineers, and the above named paper was prepared to prove the practical success of the process by the results of further extensive experience. Mr. Botley briefly describes the process as "The treatment of the gas going into the district from the outlet of the governors by adding an oil mist to it, enveloping the gas in an oily atmosphere, through which it is protected throughout its canalization whence it passes to the burners."

The London *Journal of Gas Lighting*, in commenting editorially on the paper, makes the point that "The description would have been less open to question if Mr. Botley had stopped at the first comma. Criticism is invited to talk of enveloping gas in an 'oily atmosphere.' It is contrary to fact. It is the gas itself which constitutes the atmosphere, and the oil fog is carried by it exactly as the sea fog is carried by the air." It is Mr. Botley's contention that the result of the addition of the oil fog to the gas in the distributing mains was to soften and cause to disappear, by absorption into the gas, ancient naphthalene deposits wherever found, and further, to prevent the deposition of any more naphthalene anywhere. Mr. Botley evidences by his office complaint book the fact that his carburation process has been of value in reducing complaints, and in this lies the strength of his case. The editor further says, "When Mr. Botley goes beyond and attempts to explain how it is done, as by suggesting the creation by the oil mist of an 'artificial vapor tension' in the gas mains, he makes a mistake;'" and adds the very important suggestion in saying, "We suppose it to be true, by-the-way, that the oil used is actually a solvent of naphthalene at the ordinary temperature. In his paper Mr. Botley speaks of his solvent as being a 'hydrocarbon,' and in the discussion says it is the 'ordinary tea rose oil of commerce which could be bought at 6d. per gallon.'" In the *Journal of Gas Lighting* for April 11th, 1899, in a communication, Mr. Botley writes, "The oil, however, which is used for the mist is not a light oil—as carburene or light petroleum spirit of .680 to .700 specific gravity—for such oils have not proved successful for carburation. As perhaps is now pretty well known, the oil successfully used has a specific gravity of about .800. It is really American lamp oil; and it is scarcely, therefore, what would be called 'light oil.'"

The question raised by the editor of the *Journal of Gas Lighting*, as to the solvent action of the oil on naphthalene, was interesting to me, likewise the question of the vapor tension; and having in mind the request of our President for a paper that should "Involve work less historical than experimental," I determined in my own mind, time and business permitting, to follow experimentally solvents and a study of vapor tensions. This line of work is somewhat different from the title of the paper as given by our Secretary. To give the cause underlying the formation of naphthalene involves work more rather than less historical. I regret on the nature of naphthalene I can give you no new truths. A few definitions and a brief review of the subject may be of value. Naphthalene, $C_{10}H_8$, is formed by the action of heat on organic substances, but only at rather high temperatures. For us as gas engineers, we confine our formation to the destructive distillation of coal or oil.

By destructive distillation we mean the decomposition of coal, or the fractionating of oil in closed vessels, and the process is performed in such a manner as to obtain liquid products.

A liquid product from the manufacture of coal gas is tar, or specifically coal gas tar, and a liquid product, or more correctly, educt from the manufacture of carbureted water gas or oil gas, is tar; or, specifically, water gas tar or oil tar. In both coal gas tar and water gas tar naphthalene occurs, in very varying quantities, and it is believed the presence of naphthalene in the gas is due to the fractional distillation of a portion of the tar in the retorts or the superheaters. In coal gas tar the quantity greatly increased with the use of fireclay retorts worked at high heats, and in water gas tar naphthalene became very much in evidence when the heavy oils, crude oil and gas oil so called, began to be used and were gasified at the high temperatures at which gas naphtha had been handled. Experience with water gas soon demonstrated the necessity of greatly increased superheating capacity, double superheaters, lower heats and longer continued surface contact with the checker brick to successfully handle the gas oils containing varying, but always large, percentages of residuum. When the change from gas naphtha to gas oil was made, oil efficiencies fell, because a fraction of the oil was now tar instead of gas, and the effect of the high heats on the tar brought about the formation of naphthalene, still further absorbing illuminants from the gas, the results being decreased candle power, to be made up by a much larger use of oil for enricher; and the necessity for this relatively larger quantity of oil used, if not met by increase in size of apparatus, meant also decreased capacity as well as decreased efficiency with the old type of apparatus. It was a

problem for water gas engineers to maintain the balance between capacity, efficiency and economy when introducing the use of the heavy gas oils. With gas naphtha an efficiency of 6 candles, and better, per gallon of naphtha used was good practice and quite possible. The production of tar was a negligible quantity. With gas oil in use at Grand Rapids in 1898, the oil efficiency was 5.77 candles per gallon, the oil tar produced was .0655 gallons per 1,000, the net oil efficiency was 5.86 candles per gallon—this for an average 24.48 candle gas, and the oil tar production per gallon of gas oil was .0154 gallons, or more than 1½ per cent. These are the average results. An analysis of the reports, month by month, shows the oil tar production to vary from less than 1 per cent. to more than 2½ per cent. of the gas oil used. This oil tar contains naphthalene. I have seen analysis of oil tar said to contain 10 per cent. of naphthalene. It is evident this large production of naphthalene, if carried by the gas into the mains, will cause stoppages by deposit. How to prevent the carrying forward of the naphthalene suggests to the mind the subject of condensation; and, really, a practical study of the subject of naphthalene is a study of condensation. Naphthalene is a solid at ordinary temperatures, but melts at 176° F. This melting point is most important to remember, for it is below the boiling point of water, so that boiling water or steam will melt naphthalene. It is stated naphthalene is insoluble in cold, but not quite so in hot water, so that the latter turns milky on cooling. This latter statement we have found to be true. Of the fact of the melting of naphthalene there is no question, and as long as the temperature of the condenser, or scrubber or washer is kept above 176° F., naphthalene will not deposit. It is not practical to have the temperature of the condensers and scrubbers above 176°, but it is practical and desirable to have the temperature of the wash box above 176°, and the tar overflow to the seal pots is a good place to watch the formation of naphthalene. The evaporation of the light oils from the surface of the hot tar and water leaves the shining scales of naphthalene deposited on the sides and tops of the seal pots.

At Paterson, N. J., the old water gas apparatus had a horizontal seal or wash box connected between the circular washer seals in vogue today and the scrubbers. This horizontal wash box was the original seal put in by Professor Lowe in 1882, when the apparatus was installed. It was a relic of the earlier days of water gas manufacture, and it was venerated at those works as though endowed with a magical gift for preventing naphthalene. It was really only a hot washer, but it gave us the additional hot washing capacity, and unquestionably gave improved oil results and a certain freedom from naphthalene, even when using the crude oils. We were blessed, too, with ample condensers, and when it is considered the relief holder system of water gas manufacture adds an atmospheric condenser to the apparatus, the freedom which water gas plants have enjoyed from naphthalene troubles is in a large measure explained.

At Grand Rapids we depend upon the conventional washer seal, and maintain the temperature of the wash water above 180° F.

Referring to the prevention of the deposit of naphthalene in coal gas. At Grand Rapids the practice obtains of carbureting the coal gas with gas naphtha in the main between the P. & A. condenser and the first vertical condenser. The gas is very free from tar at this place, and the temperature of the gas averages 110° F. We give below a table of the solubility of naphthalene at different temperatures as determined by our experiments, which shows that gas naphtha, specific gravity .740, will retain 50 per cent. by weight of naphthalene in solution of 106° F. The naphtha introduced at this point is in the form of an oil mist, and if condensed and run off into a drip will carry a large portion of naphthalene with it. Please note the difference between this method of introducing naphtha and the Hastings method. At Hastings the naphtha is added in the form of an oil mist to the gas going into the district from the outlet of the governors. The oil mist is produced by pressure, by compressing engines, but the gas is at normal or atmospheric temperature, and at these temperatures our experiments show gas naphtha has but very little solvent action on naphthalene.

To remove naphthalene deposits at the works our practice is to depend upon the fact that the melting point of naphthalene is 176°, and below the temperature of steam or boiling water. Where the apparatus or main can be by-passed the cleaning by steam or boiling water can be quickly and effectively done. Where the main is in use as an inlet to the holder, boiling naphtha is efficient.

There exists a great variety of opinion on naphthalene causes. "Governor" Hayward makes the point that when doctors of medicine get together and want to have a little argument, they bring up the old subject, "What is scrofula?" And the gas men in the same way, and for the same reason, have only to say "Naphthalene."

At this Association meeting there may exist in the minds of the members a dozen or more opinions as to the source of the naphthalene trouble, and an equal number of remedies, and all based on actual experience. The opinion may be advanced that wet coals, variable heats, the attempt to get too large a yield, any overtaxing of the generating apparatus, either coal or water gas, sudden cooling of the gas, carrying the condensing of the gas below 60° F., subjecting the gas to excessive friction or heavy back pressure, the effect of tar and liquor in the hydraulic main, the effect of tar or oil condensed upon the water in the holder tank, which liquor may take up or give off naphthalene at various seasons of the year. These have their remedy in modifying the carbonizing and generating and condensing processes, or the removal of the surface liquid from the holder tank periodically, which method I understand is practiced by Mr. Faben, at Toledo. In addition, the effect of the condensing of the aqueous vapor in the gas has been shown by M. Bremond to be related to the deposit of naphthalene, and he proposed to dry the gas to arrest this deposit. The mental attitude of gas men toward naphthalene is a curious study. All are familiar with the trouble, and are perhaps satisfied in their own mind as to the proper remedy, but attempt to reconcile or harmonize differences of opinion and the task is as difficult as to account for the will o-wisp deposits of naphthalene itself. Salvation depends upon the individual.

The *Journal of Gas Lighting* has published recently two valuable papers on the subject of naphthalene. The first, in the issue of Feb. 21, 1899, on "The Naphthalene Question," giving an abstract translation of a paper on the subject, by Dr. P. Eitner, of Carlsruhe, read before the Mid-Rhenish Association of Gas and Water Engineers; and the second, in the issue of March 28, 1899, on "The Relation of the Determination of the Vapor Tensions of the Condensible Hydrocarbons of Coal Gas to the Questions of Naphthalene Deposits and Benzene Enrichment," by Wilfrid Irwin, F.C.S., read before the Manchester Section of the Society of Chemical Industry.

Both of these papers are in line with our President's request for experimental results. Mr. Irwin shows there is a very extensive field for enrichment of coal gas, or the mechanical addition of hydrocarbons, and proposes benzene enrichment. He states but 22.5 per cent. of the gas is saturated with the lower boiling aromatic hydrocarbons, such as benzene, toluene, xylene and cumene, leaving 77.5 per cent. to be saturated with those boiling at a higher temperature, or rather possessing a lower vapor tension at the ordinary temperatures. Mr. Irwin adds:

"In gases produced at higher temperatures the only other substance possessing an appreciable vapor tension is naphthalene, which is present in very large excess. Hence at 15° C. something approaching 77½ per cent. of the gas is saturated with naphthalene. Taking the vapor tension of naphthalene as 0.03 m.m., we find that in 10,000 cubic feet of gas there would be present 0.1 pound of naphthalene. At 25° C. there would be over 0.2 pound of naphthalene, capable of being retained in the gas; and as an enormous quantity of it is always in reserve in the hot gases (especially large in the tar), the cooled gas would be if anything supersaturated. On testing cooled crude gas for naphthalene I have not, however, found much more than I might expect from the vapor tension, and the principal, though not the only, cause for its deposition in the mains must be accounted for, not by supersaturation, but by variations in temperature."

To replace naphthalene in saturating the remaining 77½ per cent. of gas, the use of benzene is recommended. "Indeed with benzene at the present price there is no source of enrichment, whether by water gas, cannel or any other material, which can at all compare with it on the grounds both of economy and efficiency in every respect."

To determine the effect of benzene in coal gas we passed the gas over benzene contained in a simple Hempel burette—80.3 c.c. coal gas was used as a sample, and exposure to benzene for one minute increased the volume to 95.7 c.c., or an increase of 19.18 per cent. Successive observations of one minute were made with a gradual reduction in volume until after 19 minutes a constant reading of 90.6 c.c. was obtained, or an increase of 12.82 per cent. An analysis of this gas showed 15.56 per cent. benzene vapor and 1.21 per cent. heavy hydrocarbons. It is evident the vapor tension of benzene will permit coal gas to carry a much larger percentage of benzene in the gas, and the success of high temperature carbonization, in addition to the increased make of gas, is the greatly increased production of benzene, valuable as an illuminant. The drawback, apart from mechanical considerations, is the greater production of naphthalene.

Dr. Eitner's paper on "The Naphthaline Question" is a most valuable contribution to the solution of the problem. His treatment of the subject is undertaken from the standpoint of the laboratory, and his

results indicate primarily how the existing naphthalene deposits may be removed; and also afford a scheme for the prevention of the occurrence of naphthalene stoppages. He does not attempt any practical application of the theories he has offered, and I had hoped to be able to offer you the results of a working trial at Grand Rapids. Dr. Eitner's scheme involves the judicious carbureting of gas with solvent naphtha. Unfortunately there exists an uncertainty as to the grade of naphtha used. Dr. Eitner quotes the cost of solvent naphtha at 4½d. (9¼c.) per gallon. I wrote to the Standard Oil Company for prices on solvent naphtha, and the other hydrocarbon solvents Dr. Eitner mentions, for I thought if there was anything in petroleum the Standard Oil Company would be sure to have it; but in reply to my letter Mr. Higgins writes, petroleum products as solvents for naphthalene are not in his line, and as a carbureting agent he had nothing better than the light gasolenes. Fortunately I learned the coal tar distillers produce various grades of naphtha, and I wrote to Dr. H. W. Jayne, Manager of the Chemical Department, Barrett Manufacturing Company, Philadelphia. Dr. Jayne in reply says Dr. Eitner makes a serious error in the estimate of the cost of xylene (solvent naphtha.) A pure xylene boiling at 135° to 140° is worth $1.20 per gallon, owing to the difficulty of refining through a fine column still at this high temperature where fire cannot be used. Dr. Jayne could furnish a solvent naphtha in barrel lots at 40 cents per gallon. This naphtha is water white, and has been purified thoroughly to remove all naphthalene. Dr. Jayne thinks the material Dr. Eitner has in mind is something very crude, in which case it would already be completely saturated with naphthalene, and would hardly offer any advantage as a solvent. Dr. Jayne has a crude solvent naphtha which he offers at 30 cents a gallon, but says it might contain 15 to 20 per cent. of naphthalene. The editor of the *Journal of Gas Lighting* criticizes this point also, and says probably a crude coal tar naphtha is intended, and adds, such a liquid consists by no means chiefly of xylene.

To make sure of Dr. Eitner's position, I wrote to him and will read his reply:

CARLSRUHE, GERMANY, April 26, 1897.

MR. PAUL DOTY, Grand Rapids, Mich.:

Dear Sir—I received your letter of the 4th of April, and hasten to answer the same.

I must acknowledge that the price of solvent naphtha in my original paper was erroneously given at 10 marks per 100 kilogrammes—the present price is about 30 marks per 100 kilogrammes. I believe, however, the price of solvent naphtha is not of prime importance, as the process is chiefly designed to reach local naphthalene stoppages through local carburation of the gas. For this purpose only a relatively small amount of solvent naphtha would be employed. The advantage of quickly and thoroughly removing the naphthalene obstruction without causing the flame to become smoky will amply repay the cost of the oil. A solvent naphtha costs about one fourth as much as alcohol, which has been generally used, and if benzene or petroleum ether be used the flame becomes smoky.

The best method of avoiding naphthalene stoppages in coal gas works is, and remains, an efficient, ample condensing apparatus. A general carburation of illuminating gas with solvent naphtha would hardly be advisable except for such plants as are obliged to operate with deficient condensing apparatus.

When the coal gas does not in itself contain a sufficient amount of the heavier tar oils (toluol and xylol) to prevent the separation of naphthalene crystals, by carburation with a small amount of solvent naphtha the deficiency can be made up so that no naphthalene will be deposited. The cost of the process in such cases is of little importance, for the operation would be carried on only during the heaviest winter consumption. It is not necessary to use a pure solvent naphtha; a crude product is sufficient. The xylol you are using, which boils at 130°-140° C., is a pure product. Solvent naphtha (90 per cent.) distilling to 160° C., is amply sufficient for this purpose.

For papers received, my best thanks.

(Signed) DR. P. EITNER.

Dr. Eitner gives in his paper an explanation of the possible formation of naphthalene and benzene from the gasification of coal. His paper has a number of valuable tables, No. 1 giving the composition by weight and volume of coal gas; table No. 2 showing the yield from 100 parts by weight of gas coal, in which the tar contains 6 per cent. of naphthalene, and the gas contains traces. On the latter point Dr. Eitner thinks some influence is at work which withdraws naphthalene from the gas, and the cause he attributes to the solvent power of the constituents of the tar for naphthalene. He confirms the rule which experience has taught—that good and abundant condensation is the best means of avoiding naphthalene stoppages. Where condensation is inadequate and naphthalene troubles occur, Dr. Eitner proposes carbureting the gas with the vapor of a good solvent for naphthalene, and in order that the treatment of the gas may prove practical, the carbureting liquid which is imparted to the gas he says must fulfill four conditions:

1st. It must have a very great solvent action for naphthalene.

2d. The quantity of liquor required must be as small as possible.

3d. The illuminating power of the gas must not be appreciably affected by it.

4th. Its price must be so low that the cost of the process is not excessive.

Dr. Eitner gives, in his Table 3, the solubility of naphthalene at different temperatures, for alcohol, petroleum-ether, benzene, toluene and xylene (solvent naphtha). We were able to check the work on this table for alcohol, benzene and toluene. We show in addition a table giving results for gas naphtha, kerosene, and wood alcohol:

Solvent.	Weight of 100 c.c. at 50° F.	Temperature of Crystallization with 50 per Cent. of Naphthalene in Solution.
Benzene	88.981 grams.	55° F.
Toluene	87.354 "	67° F.
Xylene (solvent naphtha)	87.019 "	74° F.
Crude xylene	89.366 "	80° F.
Gas naphtha	74.071 "	106° F.
Kerosene	80.384 "	115° F.
Wood alcohol	82.044 "	118° F.

Dr. Eitner says the best solvent is benzene, and our table confirms this. We added gas naphtha, kerosene and wood alcohol for the reason these liquids are in common use for removing naphthalene stoppages in lamp posts and services during the winter season. While gas naphtha and kerosene are slightly better solvents than wood alcohol, the latter is far more volatile, and will probably carry the naphthalene to the burner where it is valuable as an illuminant, while the gas naphtha and kerosene will run back to the drip and require removal. Our experiments would show solvent naphtha even at 40 cents per gallon to be far superior to wood alcohol for removing local stoppages of naphthalene. The objection to gas naphtha and kerosene for this purpose does not apply to solvent naphtha, for the latter is very volatile at ordinary temperatures.

Dr. Eitner's Table 4 gives the tension at different temperature for the various solvents, from which he calculates and shows in his Table 5 the quantity of each liquid which 1 cubic foot of gas takes up in order to become saturated with its vapor. Tables 6, 7, 8 and 9 shows the effect of cooling the gas through various ranges of temperature, and its relation to the deposit of naphthalene. His Table 10 gives prices of his solvents, of cost of the process for 100 grains of naphthalene dissolved when gas is cooled, and from this table he concludes xylene (solvent naphtha) is the cheapest agent for use. The quantity of xylene that must be used per 1,000 cubic feet of gas cannot be stated universally, varying as it does with the condition of manufacture and condensation. As a rule, he states 8.75 grains of solvent naphtha per cubic foot of gas, or 1¼ pounds per 1,000 cubic feet, will suffice. Trial alone will determine just the quantity sufficient.

Dr. Eitner recommended xylene, not only on account of its cheapness, to which exception is made, but from the fact that less xylene remains in the gas after cooling than of the other solvents, and for this reason cannot affect the illuminating power of the gas. In the case of petroleum ether, benzene and toluene, so much of these solvents is retained by the gas that its flame becomes enlarged and is rendered smoky. The effect of xylene and Dr. Eitner's other solvents on the candle power of the gas was tried experimentally by covering the water in the wet test meter of the photometer with the liquid. The first effect was to reduce the candle power by the absorption of illuminants; in the case of toluene the candle power dropped from 15.3 candles to 7.37 candles.

Experiments of this nature are reported by Mr. Norton H. Humphreys in his "Chemistry of Illuminating Gas," pages 55 and 230. With gas naphtha the following readings were made.

Coal gas, candle power normal 14.9 candles, withdrew 100 c.c. of water from meter and replaced with 100 c.c. gas naphtha, observations taken thereafter at intervals of 5 minutes.

1st reading	16.4	candles.
2d "	14.8	"
3d "	13.5	"
4th "	14.1	"
5th "	14.3	"
6th "	14.8	"
7th " constant	15.0	"

These results for gas naphtha are reported for the reason that Dr. Eitner concludes from his researches solvent naphtha is at once the most rational and cheapest means of getting rid of naphthalene deposits, whereas our investigations show gas naphtha to be the most practical solvent. Our practice of treating the gas at the works is identical with the method recommended by Dr. Eitner, and he lays stress upon the necessity of carbureting "in the warm." The temperature of the gas where the gas naphtha is applied at Grand Rapids is 110° F.

In addition to the study of the subject of solvents for naphthalene, it was our desire to experiment with the admission of uncarbureted water gas to the retorts during the carbonization of coal, with the hope of changing the vapor pressure of the gas sufficient to absorb naphthalene during the time of formation, also to increase the ammonia yield. These experiments are being made by Mr. Barthold, the superintendent of the works and a member of this Association, and the results he will report in the discussion at the meeting. Acknowledgment is made of Mr. Barthold's valued assistance in the experiments herein reported.

Whatever the method or process adopted for removal of naphthalene deposits, whether of low temperature carbonization, added condenser capacity, the use of solvents, or change of enricher for water gas, the secret of success with naphthalene must remain in the effort to retain a maximum of naphthalene vapor in solution in the gas where it is most valuable as an illuminant.

[To be Continued.]

The Difference Between Good and Bad Incandescent Electric Lamps.

Mr. Francis W. Willcox, in the *Electrical World and Engineer*, writing on the subject named in the heading, says :

There is no manufacturer of incandescent lamps, however inexperienced or limited in facilities, who does not claim to make a better lamp than any on the market. With every manufacturer claiming superiority for his product, the inquiring purchaser naturally becomes puzzled and needs must adopt some method of separating the good from the bad.

There are three things in general that distinguish high grade from low grade lamps : First, freedom from physical defects in the mechanical make-up of the lamp ; second, correctness and uniformity in rating of specified candle power and watt consumption at marked voltage ; third, degree of maintenance of candle power in service and the uniformity of performance in this respect.

Physical Defects.—The most prominent of these are loose caps or bases, bad connections in base, poor vacuum and spotted or discolored carbons. The last defects can be detected by examination of the lamp filaments by light, when they should reveal a clear, smooth, solid dark gray surface, and by burning the filament at a dull red, when it would show up thoroughly uniform and free from bright or dark spots. No lamps containing more than 10 per cent. of such defects should be accepted.

Correct and Uniform Rating.—Good lamps should measure well within 6 per cent. above or below the rated wattage and within 10 per per cent. above or below the rated candle power at the marked voltage. Correct and uniform rating produces full and uniform brilliancy, and avoids the marked contrasts so detrimental to good lighting, effects which lamps of wide range in candle power invariably give. It insures good average life by reason of the uniform initial efficiency of the lamps.

Candle Power Maintenance.—The real purpose of a lamp is to give light, and as all lamps decline in candle power after a number of hours' service, it is the relative amount of decline, other things being equal, which determines the best lamp.

Other features of incandescent lamps which, while desirable, affect the appearance of a lamp rather more than actual performance, are uniformity in size and shape of bulb and of the various parts of the lamp, as well as symmetry in form of filament and ability of filament to withstand drooping when burned in a horizontal or inclined position.

The Standard Oil Company uses in the course of the year about 17,000 incandescent lamps, and test are make to determine the make of lamp to be used. In the last series of tests the following method was pursued: First, the purchasing department bought in the open market, unknown to the manufacturers, 12 different makes of lamps. This insured obtaining an average product and avoided specially selected lamps. Second, 50 lamps of each make were bought, thus insuring sufficient lamps of each make to give fair average results. Third, the lamps were ordered all of one candle power, efficiency and voltage—16-candle power, 3.5 watts and 116 volts. This insured equality of conditions for the lamps. Fourth, the labels were scratched off and each lot of lamps was marked by numbers, the individual lamps of each lot being numbered from 1 to 50. They were then turned over to the civil engineer of the company, the purchasing department withholding the names corresponding to the lot numbers. This insured against any personal bias on the part of the testing engineer, and further provided for tabulating the results of each individual lamp. Fifth, all lamps were tested in a rotating stand photometer. This insured very accurate readings in candle power, and gave the mean horizontal candle power of each lamp at every reading. Sixth, correct and reliable instruments were used.

Direct current was employed in all cases. The watts used were obtained by multiplying volt and ammeter readings, and a Bunsen portable photometer of the grease-spot type was employed to obtain the candle power.

The actual test was as follows : First, the lamps were all tested for initial candle power and wattage readings at marked voltage. The readings of each lamp were noted opposite its number. The results obtained were noted and plotted so that what may be termed the distances from the true values could be seen at a glance. All lamps coming within a certain limit were reserved for further tests, the other being rejected. As a result of this only 8 makes remained for further test. Second, 10 lamps of each make were picked out of the 8 remaining lots, those being selected that were nearest to the candle power and the efficiency ordered, *i. e.*, 16 candle power, 3.5 watts per candle power at 116 volts.

In this selection preference was given to the watts, so that the different makes would burn as near as possible to the same efficiency, a necessary condition for correct comparative results.

The necessary number of sockets for life tests were so placed that the lamps burned in a horizontal position. Each socket was labeled to correspond with its lamp. After the test each lamp would go back into the same socket so that the filaments might be kept in the same horizontal position throughout the test and the drooping tendency was thus determined. The voltage was kept constant and the candle power and current readings were taken on each lamp at the end of 50, 105, 210, 310, 405, 500 and 600 hours steady burning.

From the data thus obtained curves of candle power of each of the 10 lamps were plotted, and from these an average curve was prepared for each make of lamp. Watt curves were prepared in the same manner. A study of these data enabled the best make of lamp to be selected. As a result of the test it was definitely shown that the best lamp was worth 4 cents more than the second best, and 5.82 cents more than the third best. These figures were based on the assumption that current for lighting cost only 2½ cents per kilowatt hour, which is a low figure.

Some Non-Integrating Electric Meters.

[By Professor William Edward Ayrton, F.R.S., etc.]

Materials.—The five most important metals employed in the construction of electric meters are copper, iron, steel, phosphor-bronze, and some alloy of high resistivity. A few years ago copper of 98 per cent. conductivity (Matthiesen's standard) was considered good ; now it is stated copper of 105 per cent. conductivity can be obtained commercially from Mouchel, of France. The great increase in the electric conductivity has been attributed to greater density of the material ; but there seems to be considerable doubt about this, and it is desirable to try whether a still further electric improvement, possibly even a relatively large one, might not be produced by using much greater care in removing the last traces of impurities. It is also important to find out exactly how the variation of resistance with temperature increases with increase in the electrical purity.

Soft iron for needles of electrical instruments should have small remanent magnetism and small coercive force, while both these qualities should be large in steel for permanent magnets. A large magnetic improvement has been effected in commercial soft iron during the last few years, and even steel can now be purchased in ingots having a far smaller coercive force than the so-called "soft" iron practically employed for electric apparatus 6 or 7 years ago ; and, by constructing the meter so that the magnetic induction is kept low, soft iron instruments may be used for measuring alternating currents and pressures with fair accuracy. It should be remembered, however, that although the number of turns and the maximum scale reading may correspond with a number of ampere turns which produce only a small induction with a sine or a flat wave, such instruments may read wrongly if the wave be peaked.

A satisfactory compensation for variation in the frequency is effected

by shunting the instrument with a self-induction, and experiments should be made to devise some such device to compensate for the wave having a peak.

The manufacture of steel magnets has much improved during the past few years, as indicated by the following results obtained from tests on steel magnetized with a force exceeding 200 :

	Residual Magnetism.	Coercive Force.
1885. Oil hardened steel tested by Dr. J. Hopkinson	11,300	12
1893. Glass-hard pianoforte wire tested by Professor Ewing	9,500	45
1898. Molybdenum steel tested by Madame Curie....	..	85

This marked increase in the coercive force, which is of great importance in preserving the constancy of permanent magnet types of measuring instruments, has been brought about partly by improvement in the composition of the material, and partly by greater experience having been gained regarding the proper way of hardening magnets. Still greater improvement may certainly be anticipated.

In instruments employing a spring control, and in which, for magnetic reasons, steel cannot be used, phosphor-bronze is the best elastic metal, but it is far excelled by quartz as regards the absence of sub-permanent set. A really satisfactory method of coating quartz with even a metallic layer of sufficient conductance to serve as the flexible electrode for an electro-static voltmeter using a spring control is very desirable, but better still some metallic alloy possessing the mechanical properties of quartz is well worth seeking.

Alloys possessing higher and higher resistivities and smaller and smaller temperature coefficients are being constantly brought to notice, but no one seems to be seeking for a substance with a small temperature coefficient and a small resistivity, although that is the kind of substance that is needed for many purposes, as, for example, to wind voltmeter coils with, and the bobbins of moving coil instruments used with a shunt for the measurement of large currents.

Galvanometers.—The moving coil type of instrument has effected a revolution in galvanometry, and where low resistance and short period are desired, it greatly surpasses the moving nedle type. No moving coil galvanometer, however, has yet been constructed that will even indicate the existence of the small currents which certain moving needle galvanometers will measure accurately. Development of the moving coil type of instrument is at present limited by the comparative smallness of the field produced by a permanent magnet, the limiting thinness that can be given to the strip of metal used for the suspension, and the slight trace of magnetism that remains in the so-called non-magnetic materials, used in constructing the coil, even after the application of the best method for freeing them from magnetism. In view, however, of the great improvements that have been introduced into moving coil types of galvanometers during the past few years, and of the fact that a given volume of wire possesses such an enormously greater value in the moving coil than in the ordinary moving needle type of instrument, it may not be too sanguine to look forward to moving coil galvanometers rivaling moving needle galvanometers for all purposes.

Ammeters and Voltmeters.—Instruments depending on the action of one coil on another without iron generally use a working field of about 50. Therefore, since the field on a central station switchboard often exceeds 20, the disturbance may be very great. Indeed, the error arising from the current in the leads alone of such an instrument may be serious. The importance of using copper of much higher conductivity than at present obtainable, so as to employ many more convolutions of wire without increasing either the volume or the resistance of a coil, is here manifest. Some soft iron needle instruments have also fields not exceeding about 70, and are, therefore, quite useless for central station work, unless protected in special ways with soft iron magnetic shields.

The field in which the coil of some moving coil instruments turn is as high as 1,200, and it might be expected that small stray fields would produce no error. But, as a matter of fact, the iron pole pieces, and especially the iron core, concentrate the stray field on the coil ; so that a stray field of only 0.5 when parallel to the field of the instrument may produce an error of 0.4 per cent., or nearly ten times as great as the ratio of the fields alone would lead one to expect. The employment, however, of an astatic pair of narrow coils without an iron core greatly reduces this error.

For measuring large alternating currents it is desirable to employ a small transformer giving a maximum secondary current of some 10 amperes, which can be easily led to an ammeter at a safe distance from the main cable, and by keeping the resistance of the secondary circuit low, the transformation ratio will not be affected by changes of frequency. The best way at present of measuring small alternating currents is by means of an electrostatic voltmeter shunting a non-inductive resistance.

Electrostatic voltmeters have practically no errors due to stray magnetic fields, unless they are rapidly alternating. In that case, unless the needle and inductors be properly subdivided, eddy currents may be induced and a disturbing force introduced. The error due to impedance is practically zero, as the capacity of a dead-beat electrostatic voltmeter with a 12-inch pointer need not exceed about 30 millionths of a micro-farad. Pivot friction and brush discharge between the needle and inductors introduce the greatest troubles, and it is difficult to obtain as much damping as is desirable. Coating the inductors with mica, enamel, etc., greatly reduces sparking between them and the needle, but not the brush discharge with an alternating potential difference, and is, therefore, of little practical use. A better method of stopping the brush discharge than by immersing the whole instrument in oil is much needed.

Megohm Meters.—Direct-reading ohm meters, measuring up to 50 megohms, are now obtainable, but apparatus is also needed to enable the insulation of an electric light cable to be tested where laid. At present cable is often supplied which, although possessing only a fraction of the specified insulation, is passed because suitable testing apparatus can be used only in a laboratory.

The Volumetric Estimation of Carbon.

By MM. H. IMBERT and P. COMPAN.

We undertook the following experiments with a view to the estimation of the pure carbon deposited in very thin layers on sheets of glass. The process depends on the following facts :

A sulphuric solution of chromic acid oxidizes carbon, giving carbonic acid and chromic sulphate. By disregarding the sulphuric acid we can represent the reaction by the formula—

$$(1).\ 3C + 4Cr_2O_3 = 2Cr_2O_3 + 3CO_2,$$

from which it follows that 36 of carbon corresponds to 400 of chromic acid reduced. Again, a sulphuric solution of chromic acid acts on iodide of potassium in excess, setting iodine at liberty according to the equation—

$$(2).\ 2CrO_3 + 6KI + 3H_2O = Cr_2O_3 + 6KOH + 3I_2.$$

100 of CrO_3 sets free $3 \times 127 = 381$ of iodine, which can be titrated by means of hyposulphite of soda.

Extremely small quantities of carbon can be estimated by this process. We operated in the following manner :

A known weight of carbon, placed in a beaker, is treated with a known excess of a titrated solution of chromic acid and a little sulphuric acid at 4 per cent.; the solution is first evaporated on a sand bath, then—when it is brought to a small volume—on a water bath.

The color does not appear to be modified until the liquid takes a syrupy consistence, but at this moment it shows a yellow to a greenish yellow tint (a decided greenish blue tint indicates that the quantity of chromic acid used is insufficient); under these conditions the carbon is entirely consumed. The residue, diluted with water, is then placed in a glass bromine bulb ; we add iodide of potassium in excess, and, if the iodine is not set at liberty, a further quantity of sulphuric acid at 4 per cent. is added. The liquid is exhausted four or five times with sulphide of carbon, which is collected in a glass-stoppered flask ; when this exhaustion is complete, the sulphide of carbon remains colorless, and the supernatant liquid has a greenish blue tint.

The sulpho-carbonic solution of iodine is agitated with bicarbonate of soda at 5 per cent., to neutralize the free sulphuric acid, and then titrated by means of hyposulphite of soda with the usual precautions.

From the volume of hyposulphite employed we deduce the chromic acid remaining, and, by difference, that used. According to equation (2) we calculate the weight of carbon which has been consumed.

We have operated on successive weights of carbon of 0.018, 0.040 and 0.025 grm., and have found 0.0171, 0.0388 and 0.02422 grm.

This carbon was prepared by the deposition of lampblack on a sheet of glass, which was subsequently washed with alcohol (Crova and Compan, *Comptes Rendus*, cxxvi., 707) to remove pyrogenous products ; the concordance of the results shows that the carbon was practically pure.

This method is of very great sensitiveness ; in operating on a solution of 3.81 grms. of hyposulphite of soda per liter, corresponding to 1.945 grms. of iodine, we can very easily recognize the complete discoloration

of the sulphide of carbon to one drop: Now 0.0111 grm. of chromic acid corresponds to 0.0423 grm. of iodine and to 0 001 grm. of carbon.

Between two successive operations carried out on the same volume of CrO_3, before and after reduction by carbon, 0.001 grm. of the former corresponded to a loss of 0.0423 grm. of iodine set at liberty, and consequently to a difference of 21.7 c.c. of hyposulphite used.

We then operated on a microscopic cover glass, covered with a thin film of alcohol washed lampblack. The titrated solutions corresponded to the hyposulphite solution at 3.8 grms. per liter, and we were thus able to estimate 0.0013 grm. of carbon deposited. The sensitiveness of the method, in our opinion, enables us to accurately estimate 1 m.grm.

In devising this method we had to consider the estimation of chromic acid by the liberation of iodine, an iodide and the titration of the iodine.

The results obtained corresponded very accurately with those obtained by ponderable means, by precipitation in the state of chromate of lead.

The facility with which the iodine is set free in the cold, by a sulphuric solution of chromic acid, has led us to effect the separation of bromine from iodine by this reagent. We operated successively on—

10 cc. of a solution of iodine.
10 " " " + 10 cc. of a solution of bromine.
10 " " " + 20 " " "
10 " " " + 30 " " "

The volume of the titrated solution of hyposulphite of soda necessary for the decoloration of the sulphide of carbon was 9.80 c.c for each of these operations, no matter what excess of sulphuric and chromic acids was used. The bromine is, therefore, not set free under the conditions of the experiment; we simply experienced a little more difficulty in the exhaustion with the sulphide of carbon. It is not till after 24 hours after the separation of the iodine that the sulphide of carbon left in contact with the solution becomes colored faintly yellow.

We therefore think that M. Carnot's process, recently described in the *Bulletin* of the Chemical Society, might be modified by substituting, in the separation of the bromine and iodine, a cold sulphuric solution of chromic acid for the nitrous sulphuric acid.

Determination of Smoke.

Engineering Record says it might be justifiable to assume from the literature of the subject that one of the most difficult features of the smoke problem, abroad as well as in the United States is the determination of the fact whether or not a chimney is really smoking and, if so, how much. Mr. Bryan Donkin has recently contributed an article to the *Engineer* (London) in which this subject is discussed. What he designates as an ingenious method of determining the amount of smoke is one suggested by Dr. Fritzsch. The latter gentleman, it seems, proposes to draw off and measure the gases of combustion from a chimney or flue through a glass tube of known diameter. A given quantity of the smoke is passed through cellulose, which retains the soot; the cellulose and soot are then placed in a bottle and shaken with a definite amount of water. Before this, the same volume of water has been mixed with 2 grams of cellulose containing quantities of soot varying from 5 to 30 milligrams. The liquids of different shades thus obtained are painted on paper and furnish a scale for determining the amount of soot in any smoke. Mr. Donkin considers this method less complicated than others which he describes, which, therefore, need not be explained here.

It may be well to refer in connection with this simple method of measurement to another, which, according to a usually truthful source, was once proposed in this country, although some practical difficulties prevented its successful use in the city where it was tried. Briefly stated, the idea was to measure the distance at which smoke was visible after it left the chimney. To do this the originator of the plan proposed to measure the angle subtended by the trail of smoke when observed from a definite distance from the chimney, this length being determined by holding a scale at a certain distance from the eye. The question was raised as to whether or no the length of the smoke trail would not appear different to different observers, but this objection was met by the proposition to calibrate or standardize the eyes of the observers by comparison with those of the local smoke inspector. The scheme was tried, it is said, on the chimney of a tall office building in New York city. The observer seated himself comfortably in the belfry of a nearby church and began his observations. Unfortunately a change in the direction of the wind made it necessary for him to shift his position, so he climbed to the roof of a building from which the line of sight was perpendicular to the changed direction of the smoke. This change of base was necessary several times during the course of an hour on a March day when the weather was not all that might be desired, so the originator of the scheme abandoned all idea of making money out of his invention in New York. Aside from the inconvenience of thus changing the location of the observer, the idea was, of course, quite as simple as that of the German doctor.

Mr. Donkin states that the best smoke scale at present in use is the Rinzelmann, which compares the different gray tints into which the shades of smoke naturally fall, by means of black intersecting lines on white paper. These black and white lines, if viewed at a given distance from the eye, approximate to the different shades of gray of smoke. Variations of the shade are obtained by changing of the thicknesses of the black lines or the size of the interstices of white.

However efficient any of these methods may be, it would seem best for a smoke ordinance to prohibit absolutely the emission of smoke at all times, for it has been definitely demonstrated that the measurement, even approximately, of the amount of smoke issuing from a chimney is a difficult problem. Possibly, however, in a strictly scientific investigation of smoke-consuming devices an expert may be justified in running at a fixed distance about the chimney under the investigation as a center, as is apparently necessary in the second method described.

The Soldering of Aluminum.

The *Metal Worker* says that scarcely a week passes that it is not in receipt of one or more inquiries from correspondents in all parts of the country in regard to methods of soldering aluminum. For the benefit of those interested in this question it prints the following circular on the subject of aluminum solders issued by the Pittsburg Reduction Company:

The soldering of aluminum has always been a difficult problem, and the problem has not been, up to the present time, completely solved. The difficulties in soldering aluminum arise from—

1. The high heat conductivity of aluminum; and
2. The fact that none of the ordinary soldering salts, or any easily obtainable soldering salt, will clean the surface of aluminum.

On account of the high heat conductivity of aluminum the heat from a soldering iron is conveyed away from the iron and from the solder so rapidly that the solder does not become sufficiently liquid to flow readily. This can be overcome to a large extent by taking steps to counterbalance the spreading of the heat. If the aluminum pieces to be soldered are small and thin, then naturally the difficulty is not so great as when the aluminum pieces are heavy and absorb a large amount of heat. In this latter case the soldering iron should be kept at a higher heat than is usual, and the aluminum pieces should, if possible, have been warmed beforehand.

Whereas aluminum is properly spoken of as a non-oxidizable metal, nevertheless the surface is covered with a very thin film of oxide, which prevents the solder from amalgamating with the aluminum. The most natural and simple way to remove this coating is to scrape it off with emery cloth or a file. If this is not possible, then it can be done by dipping the edges to be joined in a solution composed of about—

1 part hydrofluoric acid,
10 parts nitric acid,
50 parts water,

or in a solution, first of caustic soda, and then strong sulphuric acid.

Many manufacturers, after some attempts with indifferent results, are now soldering aluminum with considerable success. Experience seems to be a very important factor in the successful accomplishment of the soldering of aluminum. A workman who perhaps is experienced in the soldering of other metals will meet with considerable difficulty in the soldering of aluminum, but these difficulties become less and in time practically vanish as the experience of the workman increases.

The Pittsburgh Reduction Company do not, however, recommend soldering, if any other means of making a joint can be employed. Soldered joints in aluminum, even when well made, are not as strong as soldered joints in other metals, and on account of the galvanic action between the solder and the aluminum the joint will gradually disintegrate, especially if by exposure to water or by other means the conditions are particularly favorable for galvanic action. In dry places, however, a soldered joint will apparently last an indefinite time. Samples of soldered joints submitted to the Pittsburgh Reduction Company a number of years ago, and which have been kept in the office, are quite as good now as when first sent.

In view of the high heat conductivity of aluminum it follows that a solder which will melt at as low a temperature as possible should be used. There are a number of solders on the market having this characteristic, or one can easily be made to suit the occasion. Nearly all aluminum solders contain a small portion of phosphor tin.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, ENGLAND, June 10, 1899.

Gas as a Fuel.—Gas Engines.—One Thousand Candle Hours for One Penny.—Destruction of a Gasholder.—"Me Thinks there are Seven Richmonds in the Field!"

Mr. Lawson Tait, of Masons Science College, Birmingham, has been lecturing on the advantages and disadvantages of gas as a fuel, at Llandudno, and the lecture has been published in pamphlet form suitable for issue by gas companies and other interested parties to their customers. Mr. Tait commences his lecture by an enthusiastic appeal on behalf of municipal ownership, and talks about a time when the Public Authority will be a self-paying concern, and no rates will be needed; which, in other words, means that the rates will be paid by users of gas, water, etc., instead of by the owners of property. As yet, however, this is a vision of the future, and as a general rule the rates are quite as high in towns where municipal ownership is rampant as in places where local enterprise is fully encouraged. Gas companies can scarcely be expected to issue a pamphlet advocating their own annihilation, and I am afraid that the gas manager who overlooks this point may have a bad quarter of an hour with the directors and shareholders. If the scope of the lecture could be limited to its title, as might be done by eliminating the first two paragraphs, I would recommend it as in every way suited for the purpose it is intended to fill. The author has used gas for all domestic heating purposes for over a quarter of a century, and is therefore able to speak from experience, which gives his utterances a very different tone from those which deal with the possibilities of schemes which have not yet advanced beyond the paper stage. He observes that in the ordinary fireplace 95 per cent. of the heat is carried up the chimney and wasted, leaving only 5 per cent. to be distributed into the room, and also that as a result of incomplete combustion large quantities of poisonous fumes are sent into the open air. He very rightly points out the importance of a flue or chimney in connection with the combustion of gas, and makes some very pertinent remarks on the question of chimneys that do not draw properly. For gas fires he recommends sanitary glazed pipes, 6 to 9 inches diameter, built into solid brickwork, with the sockets turned upwards and well cemented. With these there will be no back draught, and they afford good ventilation. These and several other points in connection with the fixing of gas fires should be read and appreciated by every user of gas.

Apart from the well known advantages of gas fires the financial aspect is astonishing. Using gas for warming over 40 rooms, the gas bill averages £150 to £200 per annum, but the saving of servants' wages and other household necessaries was so great that Mr. Tait found that he was £400 per annum to the good by using gas instead of coal. From this he turns to the benefit of gas as a means of preventing fogs in large cities. In concluding he describes the method adopted for heating water. The secret of success is to apply a small quantity of burning gas to a large volume of water, to allow the heating to take place slowly, and to take every care to prevent the heat once absorbed by the water from leaving it until it comes to be used. By an apparatus designed on this principle he provides an unfailing supply of water at 150° for baths and all domestic purposes at a cost of ½d. per gallon, which is much cheaper than any system of solid fuel. After perusing Mr. Tait's pamphlet, it seems to be necessary to revise even the most sanguine estimate prepared by suppliers of gas, in regard to its economy for domestic heating as compared with solid fuels. Gas is cheap at Birmingham, but so is coal. In most English towns there is a fairly constant ratio between the cost of these two commodities, so that a comparison made in one town will be fairly correct for other parts of the country.

Mr. Bryan Donkin contributes some interesting information on the subject of gas engines in use to a recent number of the *Journal of Gas Lighting*. He dates the commencement of the sale of these machines on a commercial scale as 1877, and the most interesting point he makes is the rapid extension in their use during the last few years. At the beginning of 1897 he estimates that in Great Britain there were 25,700 gas engines at work, of which 4,600 were in London alone. At this period there were 15,700 in France and 32,000 in Germany and other countries. But in the year 1898 Messrs. Crossley report a sale of nearly 3,000 engines, and as several other makers are now on the market, the inference is that the development of the gas engine trade is proceeding rapidly. In 1877 Messrs. Crossley sold 133 engines, of which the largest was 8-horse power nominal, but in 1898 the largest was 160-horse power and the average for the year 15-horse power, showing that not only the number but the size of the machines is increasing. Mr. Donkin also gives a summary of the various trades or purposes to which gas engines are applied, including 65 items, some of which are of a general character, such as "workshops." The largest gas engine mentioned is a 950-horse power at Blackpool. From the foregoing statistics it would appear that at the present time there are something like 35,000 gas engines running in the United Kingdom, representing over 500,000-horse power and consuming 1,500 to 1,600 million cubic feet of gas per annum. From which we may gather that the consumption of gas as an agent for motive power is not an insignificant line of business. A gas engine runs about 60 hours per week, whereas the lighting burner on the cooking range does not average half that time, a point which should appeal to those gentlemen who want to keep the distributing system continually at active work.

Yet a new application for gas is following in the wake of the Welsbach burner. It consists of the use of gas under pressure, by which means very high power lights can be obtained. At present it is rather too complicated for ordinary household use, but for the lighting of theatres, railway stations, markets, etc., it is by far the best and cheapest system extant, and as such is a powerful rival to the electric arc light. The compressed air supply is very cheaply furnished by the aid of water power. Gas engineers have to some extent given way to the electric arc, and have not sought to compete with it as a means of furnishing high pressure centers for business, or for ornamental lighting. But the new system has been introduced with highly satisfactory results at an important Metropolitan railway station, at the Crystal Palace, and at several music halls. A small apparatus, only 12 inches in diameter, will compress 150 cubic feet of gas per hour at a cost of less than ¼d., and the gas will yield a duty of over 30 candles per cubic foot burnt. This only means a small percentage in additional cost. In many places the total cost with a fair allowance for renewals of mantles, etc., will come down very near to the surprising figure of 1d. per 1,000 candle power per hour. These little pressure apparatus will also commend themselves to gas engineers for several purposes in connection with blowpipes, high temperature burners, carbureting apparatus, etc.

A chlorate of potash refinery is not a desirable neighbor, judging from the experiences at St. Helens, an important manufacturing town in the heart of the Lancashire colliery district. On the 12th ult. at about 10 A. M. a slight fire broke out, and was followed, before the fire brigade arrived, by an explosion that shook all the buildings in the town to their foundations and shattered every pane of glass in the neighborhood. The concussion was felt at a distance of 5 miles and the report was heard 18 miles away, while 5 persons were killed and about 50 injured. The havoc in the road of the explosion was terrible, some large vitriol chambers being completely overthrown. Next to these was the corporation gas works, and here a gasholder appears to have met the brunt of the shock, and to a large extent saved the rest of the works. The holder was up about 45 feet from the ground and the lower part was partly protected by an 8 feet wall. The force of the explosion struck the upper lift, driving it inwards about 10 feet, doubling up the roof truss and ripping up the crown sheets from one side to the other. The escaping gas was instantly ignited by burning *debris* from the chemical works, an enormous flame shot up, and the holder collapsed into an irregular heap in the center part of the tank. The guide framing consisted of cast iron columns 60 feet high, with two rows of horizontal lattice girders. It was originally a single lift, but was telescoped about 15 years ago. The columns were cracked at their bases, but remained upright, and the horizontals were undisturbed with the exception of one of the intermediates that came right in the line of the concussion. The guides were of wrought iron, and were much bent and strained at the parts in contact with the guide rollers at the time of the explosion, the greater disturbance being observable at right angles to the line of concussion, showing that the holder was squeezed and flattened before the collapse.

At the back of the unfortunate structure was a second holder of similar size, which escaped comparatively unharmed, although heavy pieces of burning wood, some several feet long, fell upon it, but were promptly removed by the workmen, who acted with commendable

bravery, being enveloped in dust, smoke and noxious fumes from the chemical works. As the result it escaped with some disturbance of the sheeting and the fracture of one column at about midway, by a falling guide roller. A governor house and a cottage residence were wrecked, and the total cost of the damage was put at £4,000. As the inner lift of the second holder remained available, and a third holder at a distance of a mile or more was not touched, the work of making and distributing gas was not stopped, but there was a temporary extinction at the time. The flame of the burning gas was 300 to 400 feet high, and created some impression in the neighborhood. A remarkable feature was that a lad of 16, attracted by the fire, ascended to the top of the holder to get a view of the same, and was there when the explosion took place. His clothing was ignited by the burning gas, but he had sufficient presence of mind to slide rapidly down the ladder and immerse himself in a tank. His injuries are severe, but that he should have escaped with no harm beyond that due to the fire, is astonishing.

Mr. Richmond has issued a reprint of his articles on "Slot Cookers," to which some allusion was made in my letter last December, in elegant pamphlet form, with all the illustrations and much additional matter. There is a slot cooker map of the British Isles, showing the towns that have adopted this system, and a detailed list showing the number of cubic feet supplied for one penny, some details of the cookers, number of brackets or pendants fitted (if any), rent charged (if any), and the prices of gas both ordinary and prepayment. Quite a respectable number make a small additional charge beyond that inserted in the slot, but the majority go the whole hog and do the thing free. I take it that the essence of the prepayment system is inclusiveness, and that the scale should be so arranged that the "penny" covers everything. The get up of the work is very neat and tasteful, and the information afforded is of an instructive and valuable character. It would be interesting if the tabulated information could include the date of the inauguration of the system, and the number of customers supplied, also the average consumption per customer.

This, after all, must be the test by which the system must stand or fall. The outlay for stoves and fittings is of a definite character and can be calculated beforehand, the outlay per annum thus becoming a definite thing. But the rate of consumption will depend upon the climate, the habits of the consumers and many other different things. For an outlay of £5, for example, there should be a return of 10s. per annum. If the slot meters are set at 8d. beyond the ordinary rate, then the consumer must use 15,000 cubic feet per annum before he pays his footing. Every thousand beyond that will be profit to the company, and every thousand below a loss.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE Kerr-Murray Manufacturing Company, of Fort Wayne, Ind., has been awarded a contract by the Bronx Gas and Electric Company, Westchester, N. Y., for the construction of an additional set of purifying boxes, and a storage holder (to rest in steel tank) rated to a capacity of 150,000 cubic feet.

MR. A. W. EBELING, connected for many years with the Otto Gas Engine Works, Philadelphia, Pa., has resigned his position as Secretary thereof. He retires with the goodwill and best wishes of all who know him.

THE opposition concern in San Francisco, Cal., known as the Equitable Gas Light Company, has reduced its selling rate all round to 65 cents per 1,000 cubic feet. The query is, how long can it manage to exist on that basis, even giving it full credit for the peculiar sort of gas that it manufactures.

THE proprietors of the Bloomington (Ind.) Gas Company report a brisk trade in gas ranges. The output is increasing in a most gratifying way.

MR. W. E. STEINWEDELL has been appointed Superintendent of the Belleville (Ills.) Gas Light and Coke Company.

A CORRESPONDENT at Elmira, N. Y., forwards the following under date of the 17th inst.: "A business transaction of considerable interest to the people of Waverly, N. Y., was completed here yesterday afternoon by which the ownership of the stock of the Gas Light Company and of the South Waverly Gas Light Company was transferred to Maurice S. Decker, of Orange, N. J., and Wm. H. Fritchman, of New York. The former owners were Messrs. Deily & Fowler, of Philadelphia, who built the plant here 26 years ago. Although the consideration is not made public, the plant and franchises are known to be valuable. On account of the Company operating in both New York and Pennsylvania, it is necessary to have two separate Companies, and these will be known by their former titles. The officers of the Company are: President, W. A. Fritchman, of New York; Secretary, Harry A. Decker, of Elmira, N.Y.; Treasurer, F. A. Gillette, of Athens, Pa. The new owners have taken possession of the business. President Fritchman says it is the intention of the Company to improve the plant and extend the service at once. He also made another announcement which will be of material interest to the gas consumers of the valley which was that about July 1st the price of gas would be reduced to $1 50 per 1,000 cubic feet. This will, no doubt, result in the addition of much business. Mr. Henry G. Merriam, who has been connected with the Company since its organization, will be retained as Superintendent, a fact which will insure correct administration of the Company's affairs. Mr. Fritchman is connected with Fritchman & Company, who have recently been granted franchises to operate gas works and lay mains in Sayre, N. Y., and Athens, Pa."

AT the annual meeting of the Coshocton (O.) Light, Fuel and Power Company, the following officers were chosen: Directors, Houston Hay, F. E. Pomene, J. C. Fisher, G. A. Hay and G. B. Edgar; President, Houston Hay; Vice-President, J. C. Fisher; Secretary and Treasurer, G. B. Edgar. The price of gas was reduced to $1.25 per 1,000 cubic feet to consumers who settle the monthly bills at the Company's office by the 10th of each month.

MR. GEORGE PETTIBONE has been appointed Superintendent and Manager of the municipal gas and electric plants of Westfield, Mass.

THE United Gas Improvement Company has been authorized to install on the works of the Mansfield (O.) Gas Light Company a set of its standard, double superheater Lowe water gas apparatus up to a daily capacity of about 250,000 cubic feet.

THE voters of the town of Williamsburg, Ind., have indorsed the proposition that the authorities shall construct and operate a gas works on municipal account. The place seems altogether too small to warrant the proposed expenditure.

WE are informed that the reorganization of the Connersville (Ind.) Gas and Electric Company has been perfected. It is capitalized in $75,000.

THE Board of Directors of the Pawtucket (R. I.) Gas Company have reappointed the following executive management: President, Lyman M. Darling; Secretary, Edward A. Perrin; Treasurer, Charles L. Knight; Superintendent, William McGregor; Collector, George A. Stiness.

SUPERINTENDENT ATWOOD has the work on the new storage holder for the Plymouth (Mass.) Gas Light Company underway.

THE Link-Belt Machinery Company, of Chicago, has just closed a contract with the Louisville (Ky.) Gas Company for the machinery required in its new generating plant for elevating, conveying and crushing coal and coke.

MR. W. H. FRITCHMAN, who is concerned in the construction of the new plant for the Athens and Sayre Gas Company, of Athens, Pa., writes us that the Company is in the market for about 300 meters, from 100 to 200 gas ranges and heaters, for 8 feet by 8 feet purifying boxes, a 40,000 feet storage holder, Welsbach burners—in fact, all kinds of gas appurtenances except generators, engines, boilers and pipe, which have already been purchased. His New York headquarters are in No. 10 Wall street.

THE following "official" pronunciamento made recently to the stockholders of the Bay State Gas Company, of Delaware, by J. Edward Addicks as its "President," should be of interest to the former:

"That the stockholders of the Bay State Gas Company, of Delaware may understand how the suits now pending and to be brought will affect their interests, your Directors issue the following:

"The Bay State Gas Company of Delaware owns the entire capital stock of the Boston, Roxbury, South Boston and Bay State, of Massachusetts, Gas Companies, with the exception of a few shares owned by J. Edward Addicks and other friendly interests. These stocks have been deposited to secure $9,000,000 first series and $3,000,000 second series Boston United Gas bonds. Up to a short time ago, when the management and control of these Companies were forcibly taken posses-

sion of by persons who had no rights or interest in them, they were free from debt, with property and assets worth $25,000,000, and were earning more than all charges.

It is the opinion of competent experts that the equities in the above named Companies owned by this Company are worth from $12,000,000 to $15,000,000.

During the past year the management and control of these Companies have been in the possession of the Dominion Coal Company, the New England Gas and Coke Company and persons who control these Companies, and said management and control have been exercised for the purpose of wrecking said Companies and securing their assets to said Dominion Coal Company and New England Gas and Coke Company and those who control them, and said efforts have been so successful that the assets of said Companies have been jeopardized and their earnings have been diverted until there is a large deficit, and the interest due July 1st on the aforesaid first and second series Boston United Gas bonds is to be defaulted.

"Your Directors, fearing the result of the illegal efforts that were being made by those who have taken forcible possession of said Companies, have been endeavoring by the sale of additional stock and assets to place your Company in a position to secure its property and rights to the end that it, the Bay State Gas Company of Delaware, is now free from debt and has on hand a large amount of cash and other quick assets and will be prepared to pay off the $12,000,000 first and second series Boston United Gas bonds and thereby obtain absolute and complete possession of all property and assets and the control and management of the four old Boston Gas Companies, to wit, the Boston, Roxbury, South Boston and Bay State, of Massachusetts, and to prosecute to a successful termination suits for large damages against the Dominion Coal Company, the New England Gas and Coke Company and the individuals who have wrongfully and unlawfully injured their properties and diverted their assets and earnings.

"Your Directors are of the opinion that the four Companies owned by this Company have been illegally used during the past year, for the sole purpose of wrecking them for the benefit of the Dominion Coal Company, and your Directors have, under the advice of the best legal talent procurable, decided to begin suits and to vigorously prosecute the same against the corporations and individuals who are responsible for the illegal acts that have been committed, and your Directors are of the opinion that the result of these suits will be the payment in full of the Boston United Gas bonds, first and second series, the acquirement of the sole ownership with perfect title to the Companies, which can secure and hold more than three-fourths of the entire gas lighting business of Boston, and your Directors are of the opinion that after these results have been secured your Company will be in receipt of annual revenue largely in excess of all fixed charges.

"Your Directors, after careful investigation and under the advice of competent experts, believe that the experiment which has been made by the Dominion Coal Company and the New England Gas and Coke Company at works in Everett, for the making of gas more advantageously than it is now made by the Companies at present supplying Boston, is a complete failure, and that in the proceedings which are to be instituted said failure will be demonstrated to all."

UNDER agreement with the Camden (N. J.) Gas Light Company the authorities have awarded the public lighting of that place, in so far as such illumination is performed by gas, to the Company for a period of 5 years. The prices agreed on are: For ordinary gas lamps (4 ft. burner), $19.50 each per annum; single Welsbach lamps, $27 each; double Welsbachs, $43 each. The lighting table is figured on an all night and every night basis.

WELSBACH lamps are now illuminating the streets of Florence, Ala., much to the satisfaction of the citizens.

THE announcement is made that the New York and Queens Gas and Electric Company has succeeded in absorbing the properties of the New York and Queens Light and Power Company, the Flushing Gas and Electric Light Company and the Newtown Light and Power Company. These properties are mainly in Queens county, N. Y. We further understand that Mr. Wilder F. Lawrence, who had practical charge of the works' end of the gas supply of Trenton, N. J., is to assume the superintendency of the gas division of the business of the New York and Queens Gas and Electric Company.

A CORRESPONDENT in Bethlehem, Pa., writing under date of the 17th inst., says that negotiations which were in progress for some time were concluded the 15th inst. By means of the agreement the plants of the Bethlehem Gas Company and the Bethlehem South Gas and Water Company, Bethlehem, Pa., have been acquired by the Wyandotte Gas Company, which will hereafter operate the same as a single enterprise.

MR. WM. D. WEST has been appointed Superintendent of the Windsor (Ont.) Gas Company.

ALL signs indicate that the owners of the San Jose (Cal) Light and Power Company, which controls the gas business of San Jose, and those of the San Jose Electric Power Company, have agreed upon a plan for amalgamating their interests.

THE Directors of the Reading (Pa.) Gas Company have again named Mr. Horatio Trexler to the Presidency.

A CORRESPONDENT in Denver, Col., says: "Mr. A. H. Branch, on his retirement from the position of Manager of the Denver Consolidated Gas Company, received a handsome testimonial. The kind wishes of the men, many of whom had worked under Mr. Branch for several years, and all of whom felt the keenest regret at his retirement, were expressed in the presentation to him of a valuable diamond stud. A letter declaring the regret of the force over his resignation, and signed by all of the force, accompanied the jewel."

THE Plymouth (Pa.) Light, Heat and Power Company has authorized the United Gas Improvement Company to remodel its works. A set of standard, double-superheater Lowe water gas apparatus, up to a daily capacity of 125,000 cubic feet, has been arranged for, and the purifying plant will be doubled in size. The proprietors of the Plymouth Company are to be congratulated on their determination to take full advantage of the possibilities of the district in which they work, which district has heretofore not received the attention that its merits deserved.

A CORRESPONDENT incloses the following: "The greater part of the stock of the Owego (N. Y.) Gas Light Company has been sold to a Scranton, Pa., syndicate. The bulk of the stock was owned by George A. King and A. P. Storrs, of Owego, who still retain a part of their holdings. The number of Directors was increased from 3 to 5, and the executive management named is as follows: Directors, W. D. Boyer and George Gearhart, Scranton, Pa.; F. E. Lyford, Waverly, N. Y.; and G. A. King and A. P. Storrs, of Owego; President, Wm. D. Boyer; Vice-President, George Gearhart; Secretary and Treasurer, F. E. Lyford. It is proposed to construct a water gas plant in the works on East Main street, retaining the existing coal gas plant as a reserve."

ON July 1st the new selling rate goes into effect at Marblehead, Mass. Under it the gross rate is reduced from $3 to $2.50 per 1,000 cubic feet, and a rearranged schedule of discounts operates so that the concession may be averaged at 20 cents per 1,000.

THE latest from Salt Lake City, Utah, is to the effect that Messrs. John Dern, E. H. Airis, George A. Lowe, E. G. Roonon and W. A. Fourness have formed the Utah Fuel and Lighting Company, which proposes to compete with the Union Light and Power Company for the supply of gas in Salt Lake City. The concern is capitalized in $200,000. The Salt Lake City *Tribune*, from which our information is obtained, further says: "The gas to be manufactured is of the water-oil variety, the process having been discovered and patented by H. Fourness, the big gas manufacturer of Manchester, England, who is the father of W. A. Fourness, the General Manager of the new Company." Which leads us to remark that, if the others concerned in the opposition enterprise are no heavier than W. A. Fourness, the existing Company need not concern itself about the scheme in any sense or manner.

THE case of the insurance company against the Louisville Gas Company is at an end, the Kentucky Court of Appeals having denied a rehearing. The insurance folks, and Messrs. Kaufman, Strauss & Co., may now settle the costs between them.

J. E. LONG, Hiram Wise, A. M. Paff, D. H. Keller and H. C. Slamp are proposing to form a Company, to be known as the Bangor Gas Company, for the manufacture and distribution of gas in the boroughs of Bangor, East Bangor and Pen Argyl, Northampton county, Pa. Bangor is about 14 miles north of Easton, and is noted for its output of fine slate. The population that could be reached by the Company numbers about 7,000, but the districts are in no sense compact.

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England—Aug. Siegle, 30 Lime Street, London.

MONDAY, JUNE 26, 1899.

The Market for Gas Securities.

There is nothing new to report in connection with the gas situation in this city. The war is still being vigorously waged, and prices for shares are nominal rather than real. Consolidated held fairly steady, the opening to-day (Friday) having been made at 179½ to 180½. Transactions, however, were few and far between. There was some inquiry for Standard common, and we know that a bid of 117 for a round lot failed to bring about a trade. The Benedict Morgan-Brady specialties (otherwise New Amsterdams) were decidedly on the weak side. The common to-day is 31½ to 32½, and the preferred is 57 to 57½. It would be well for holders to remember that this tangle in city gas affairs must be settled this year, and that when the powers who are get together the settlement will be about as speedy as the preliminaries were slow.

Brooklyn Union is, and rather unaccountably, being pressed for sale, with the result that quotations show a net loss for the week of something over 4 points. The only reason for the decline is the mixed up state of affairs in New York, for the Company is probably earning a better return on its shares than any other Company east of the Ohio river.

The general gas share list is strong, Baltimore Consolidated especially pointing the way. Bay State is spiritless. Our current item columns convey a message from Mr. Addicks to the Bay State shareholders which is worth reading. Buffalo gas is dull and lower. There is no particular change in the Cincinnati situation. Consumers, of Jersey City, is in demand, the negotiations in regard to the purchase or change of ownership in the Hudson County Gas Light Company, of Hoboken, N. J., possibly being the immediate reason for the inquiry. The Indiana syndicate Companies also exhibit signs of renewed animation on the belief that the proposed dollar gas rate for Indianapolis is a fixed fact.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

JUNE 26.

☞ All communications will receive particular attention

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$39,078,000	100	179	180
Central Union, Bonds, 5's.	3,000,000	1,000	107½	108½
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	115	118
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	250	..
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	.
New Amsterdam Gas Co.	13,000,000	100	31¼	32½
Preferred	10,000,000	100	57	57½
Bonds, 5's	11,000,000	1,000	100½	101
Northern Union, Bonds, 5's.	1,250,000	1,000	95	97
New York and East River..				
Bonds 1st 5's	3,500,000	1,000	109	111
" 1st Con. 5's	1,500,000	..	112	114
Richmond Co., S. I.	348,650	50	70	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	110	..
Preferred	5,000,000	100	125	..
Bonds, 1st Mortgage, 5's	1,500,000	1,000	112	114
Yonkers	299,65	500	130	.
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	136	137
" " Bonds (5's)	15 000,000	1,000	118	119
Bay State	50,000,000	50	2	2½
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	40	..
" 1st Mtg. 5's	450,000	1,000	95	98
Boston United Gas Co.—				
1s Series S. F. Trust	7,000,000	1,000	92	..
2d " " "	3,000,000	1,000	68	71
Buffalo City Gas Co.	5,500,000	100	10	11
" " Bonds, 5's	5,250,000	1,000	84	85
Central, San Francisco	2,000,000	..	105	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Columbus	1,144,700	100	70	75
1st Mortgage	1,207,000	1,000	106	108
Consumers, Jersey City	2,000,000	100	95	.
" Bonds	600,000	1,000	107½	110
Cincinnati G. & C. Co.	8,500,000	100	186	187
Consumers, Toronto	1,700,000	50	230	235
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Consolidated, Baltimore	11,000,000	100	63	64
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's.	1,000,000	..	..	..
Equitable, 1st 6's.	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	21	23
" Con. Mtg. 5's	380,000	1,000	87	90
Consolidated G. & E. Co.'s., Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co.	4,500,000	50	65	65½
" Prior Lien 5's	4,546,000	1,000	94¼	94½
Detroit Gas Co., 5's	423,000	1,000	95½	96
" Inc. 5's	31,000	100	..	..
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	77	83
" Bonds	2,000,000	..	80	85
Grand Rapids Gas Lt. Co.	1,000,000	50	..	..
" 1st Mtg. 5's	1,125,000	1,000	..	..
Hartford	750,000	25	..	220
Indianapolis	2,000,000	..	122	128
" Bonds, 6's	2 650,000	..	105	106
Jackson Gas Co.	250,000	50	50	..
" 1st Mtg. 5's	250,000	1,000	96	100
Jersey City	750,000	20	225	275
Lafayette Gas Co., Ind.	1,000,000	100	68	70
Bonds	1,000,000	1,000	81	86
Louisville	2,570,000	50	106	108
Laclede, St. Louis	7,500,000	100	53½	54
Preferred	2,500,000	100	99	102
Bonds	10,000,000	1,000	107	108
Madison Gas & Elec. Co.	400,000	100	68	70
" 1st Mtg. 6's	350,000	1,000	102	..
Montreal, Canada	2,000,000	100	200	..
Newark, N. J., Gas Co.	1,000,000	..	200	220
Bonds, 6's	4,000,000	..	128	130x
New Haven	1,000,000	25	280	300
Nashville Gas Lt. Co.	1,000,000	50	110	..
Oakland, Cal.	2,000,000	..	53½	55
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	117½	117¾
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	111½	112
2d "	2,500,000	1,000	104	105
Peoples, Jersey City	500,000	50	215	..
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	74	75
St. Paul Gas Light Co.	1,500,000	100	50	52
1st Mortgage 6's	650,000	1,000	82	85
Extension, 6's	600,000	1,000	..	..
General Mortgage, 5's	2,428,000	1,000	80	82
St. Joseph Gas Co.	1,000,000	100	42	44
" 1st Mtg. 5's	750,000	1,000	96	99
Syracuse, N. Y.	1,750,000	100	12	14
Bonds	1,612 000	1,000	81	84
Washington, D. C	2,600,000	20	250	..
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	100	97	97¾
Bonds, 5's	3,830,500	.	106	108
Wilmington, Del.	550,000		208	..

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As Superintendent of a Gas Works.

By an energetic man experienced in the management of Gas, Electric Light and Water Works Plants. Can furnish best of references. Age, 34. Would accept position in any one of above or all combined, or as assistant in a large plant.
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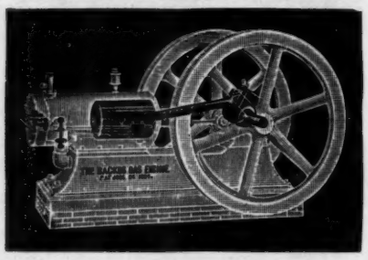

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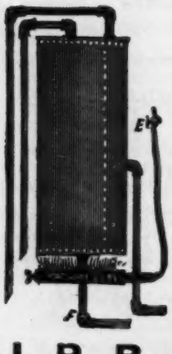

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Will heat the Water in a Boiler in less than half the time required by a Range, and at less than half the expense. Nothing to get out of order, and will last a lifetime.

BUFFALO CITY GAS CO., BUFFALO, N.Y., April 1, 1899.
J. P. B. SADTLER & Co, 813 S. Howard St., Baltimore, Md.
Gentlemen—Replying to your favor of the 30th of March. The Heller Heaters that you have already furnished seem to be large enough, and we will not at present care to use any of the larger size that you mention. We have had no complaint in regard to the Heller Heater that we have used in Buffalo, and so far they are giving us good satisfaction.
Yours very truly, E. H. JENKINS, Engineer.

BALTIMORE, MD., March 24, 1899.
J. P. B. SADTLER & Co., 813 S. Howard St., Baltimore, Md.
Gentlemen—A test of the Heller Water Heater witnessed by me March 21, 1899, showed that with a consumption of 30 feet of gas per hour, the water in a 28 gallon galvanized boiler could be heated from 59° to 102°, or 43° in one hour. Temperature of room at time of test 64°.
Respecfully,
GEO. BEADENKOPP, Ass't Engineer, Con. Gas Co

Clamp Heater to Pipe about 4 Inches away from bottom of Boiler. Always use an independent connection, or regular Gas Stove connection, so as to get a good flow of Gas.

J. P. B. SADTLER & CO., 813 South Howard Street, Baltimore, Md.

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Colchester, Eng.	300,000
Birkenhead, Eng.	2,250,000
Swindon (New Swindon Gas Co.), Eng.	120,000
Saltley Works, Birmingham, Eng. (2d Contract)	2,000,000
Windsor St. W'ks, Birming'm, Eng. (2d Contract)	2,000,000
Halifax, Eng.	1,000,000
Toronto,	250,000
Ottawa,	250,000
Toronto (Second Contract, Remodeled),	2,000,000
Lindsay (Remodeled),	125,000
Belleville,	250,000
Ottawa (Second Contract),	250,000
Brantford (Remodeled)	200,000
St. Catherine's (Remodeled),	250,000
Kingston, Pa.	125,000
Montreal,	500,000
Peterborough, Ont.	250,000
Wilkesbarre, Pa.	750,000
St. Catherine's (Second Contract),	250,000
Buffalo, N. Y.	2,000,000
Winnipeg, Man.	500,000
Colchester, Eng. (Second Contract),	300,000
York, Eng.	750,000
Rochester, Eng.	500,000
Kingston, Ont.	300,000
Crystal Palace District, Eng.	2,000,000
Duluth, Minn.	300,000
Caterham, Eng.	150,000
Enschede, Holland,	150,000
Leicester, Eng.	2,000,000

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Draughtsman and Constructing Engineer.
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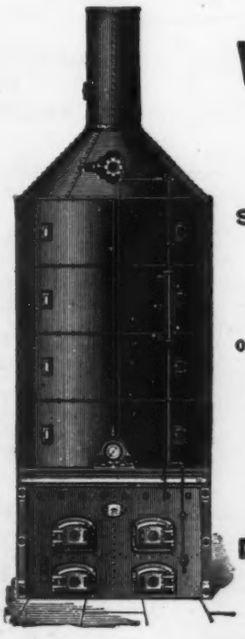

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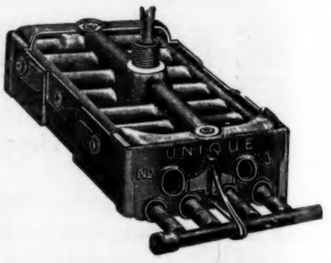
THE QUICKEST WATER HEATER MADE
USING THE SAME AMOUNT OF GAS.

SIMPLE, INEXPENSIVE, EASILY ATTACHED. CAN BE CONNECTED TO A COAL RANGE. NO VALUABLE SPACE IS WASTED, AS IT IS PLACED DIRECTLY UNDER THE BOILER, BETWEEN THE ARMS OF THE STAND.



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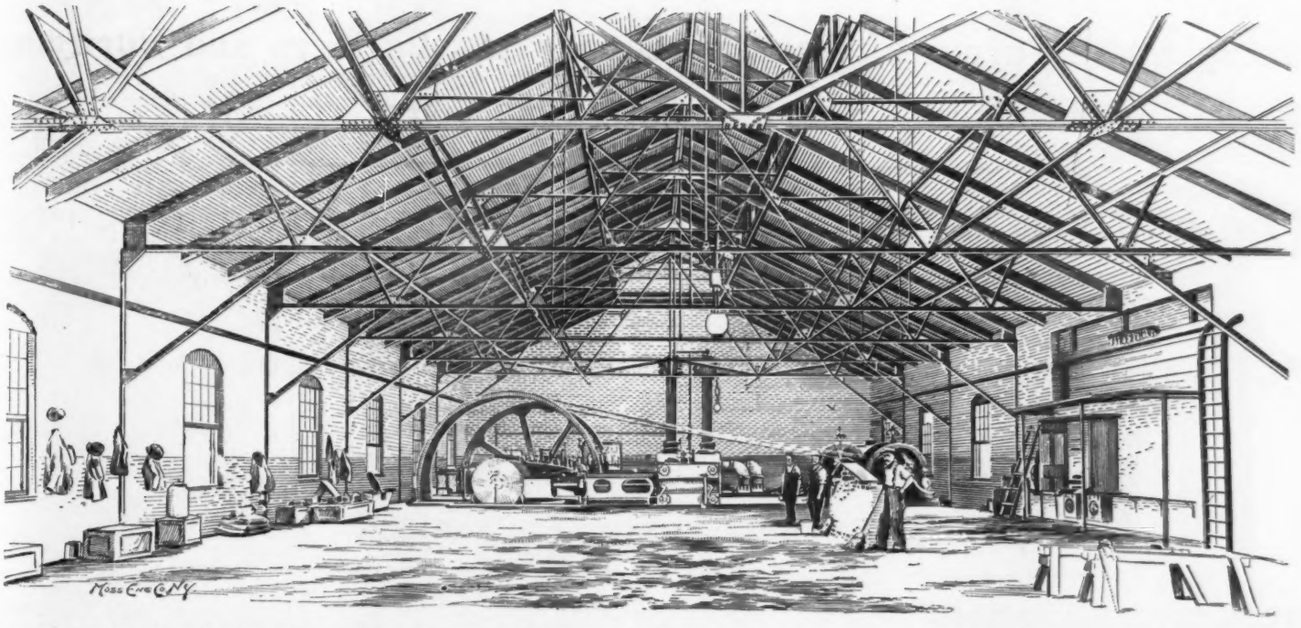

The above illustration is taken direct from a photograph and shows the interior of an Engine Room or Power House, which was designed and built by us for the Scranton Traction Company, at Scranton, Pa. The building is 60 feet wide and 120 feet long, the framework being entirely of steel. Between the steel sideposts is placed a light brick wall to protect the interior from the weather, and ventilation is secured by a monitor the full length of the building, with swinging sash on the sides. The roof is covered with slate secured to the roof plank.

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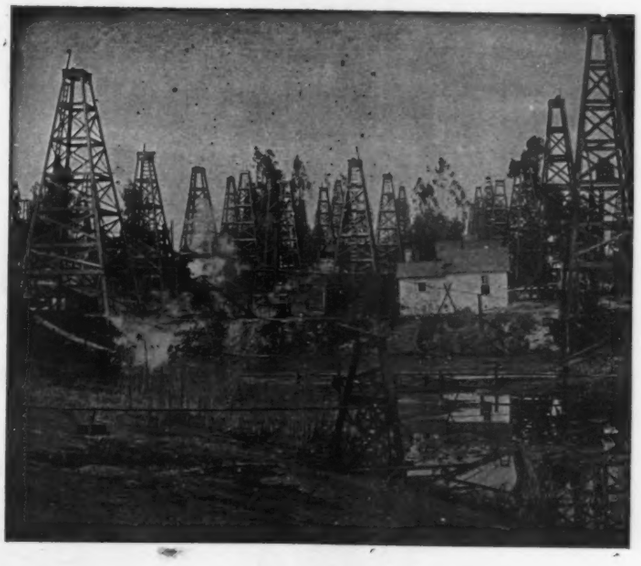
Now is the time to invest, when the first capital will be able to double itself in a single year. This is also the most delightful residence section in the United States.

We suggest to those desiring gas investments, in large or moderate amounts—with or without active business connections—to come here and investigate; or, what is the next best thing, write us for particulars and prospectus.

The accompanying cut shows the oil wells in the suburbs of Los Angeles from which the Companies under the NEW LOWE GAS PROCESS obtain their supply of oil.



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Mr. T. Viner Clarke, of London, Eng., having compiled a novel Chart or Map illustrating the various CHEMICAL PRODUCTS DERIVED FROM COAL AND COAL TAR, in the form of a Genealogical Tree, including all the products discovered (the total number amounting to near 700), offers for sale a limited number of copies in Colors, mounted on Linen, with Rollers. Price, $3.50. Orders may be sent to **A. M. CALLENDER & CO., 32 Pine Street. New York City.**

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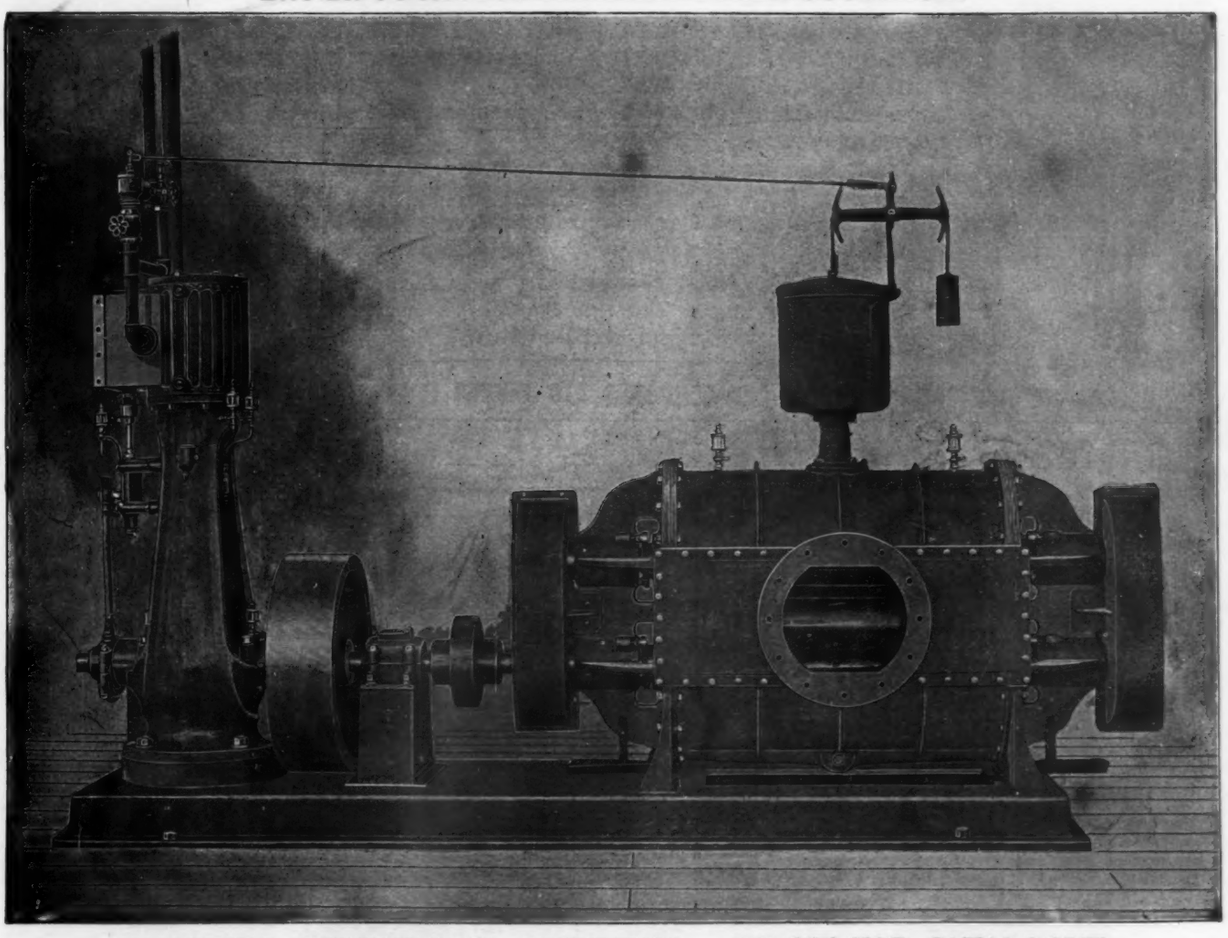

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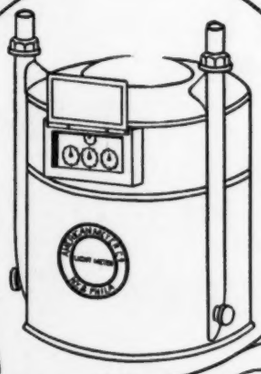

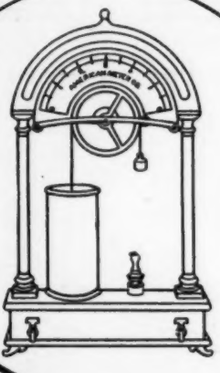

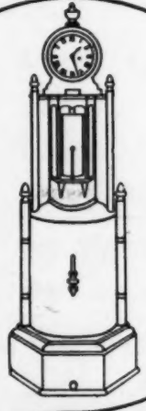

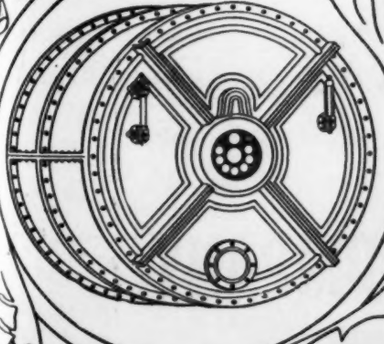

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SAN FRANCISCO.

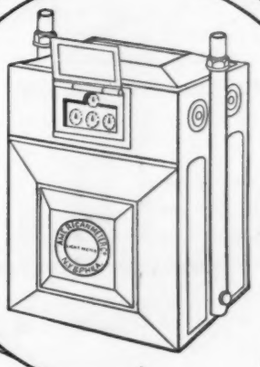
PUBLIC LIGHTING TABLE.

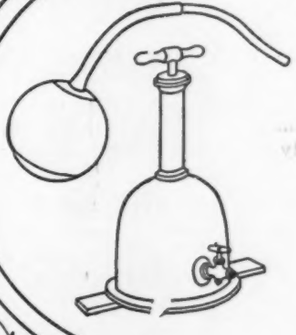
JULY, 1899.

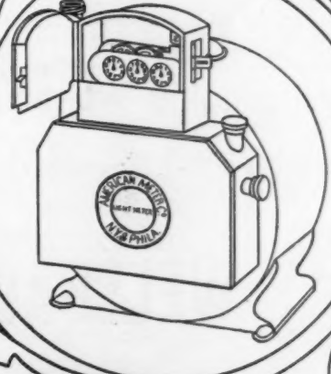
Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Sat.	1	8.00 PM	1.20 AM	7.30	3.15
Sun.	2	8.00	2.00	7.30	3.15
Mon.	3	8.00	2.40	7.30	3.15
Tue.	4	8.00	3.40	7.30	3.15
Wed.	5	8.00	3.40	7.30	3.15
Thu.	6	8.00	3.40	7.30	3.15
Fri.	7	8.00 NM	3.40	7.30	3.15
Sat.	8	8.00	3.40	7.30	3.15
Sun.	9	8.00	3.40	7.30	3.15
Mon.	10	8.00	3.40	7.30	3.15
Tue.	11	8.00	3.40	7.30	3.15
Wed.	12	8 40	3.40	7.30	3.15
Thu.	13	9.10	3.40	7.30	3.15
Fri.	14	9.30	3.40	7.30	3.15
Sat.	15	10.00 FQ	3.40	7.30	3.15
Sun.	16	10.40	3.50	7.20	3.15
Mon.	17	11.10	3.50	7.20	3.15
Tue.	18	12.00 AM	3.50	7.20	3.15
Wed.	19	1.00	3.50	7.20	3.15
Thu.	20	2.10	3.50	7.20	3.15
Fri.	21	No L.	No L.	7.20	3.15
Sat.	22	No L. FM	No L.	7.20	3.15
Sun.	23	No L.	No L.	7.20	3.15
Mon.	24	7.50 PM	9.20 PM	7.20	3.15
Tue.	25	7.50	9.50	7.20	3.15
Wed.	26	7.50	10.20	7.20	3.15
Thu.	27	7.50	10.50	7.20	3.15
Fri.	28	7.50 LQ	11.30	7.20	3.15
Sat.	29	7.50	12 00 AM	7.20	3.15
Sun.	30	7.40	12.40	7.10	3.30
Mon.	31	7.40	1.30	7.10	3.30

TOTAL HOURS LIGHTING DURING 1899.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	215.40	January	423.20
February	184.40	February	355.25
March	187.40	March	355.35
April	166.50	April	298.50
May	158.00	May	264.50
June	140.50	June	234.25
July	150.30	July	243.45
August	168.30	August	280.25
September	179.50	September	321.15
October	213.20	October	374.30
November	217.00	November	401.40
December	238.10	December	433.45
Total, yr.	2221.00	Total, yr.	3987.45







Welsbach Patent Again Sustained.

Following the recent decision in the United States Circuit Court of Appeals, sustaining the Welsbach Company's Patent, Judge Lacombe, in the United States Circuit Court, has enjoined the following infringers of the Welsbach Patent:

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The United Gas Improvement Company,

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THE STANDARD DOUBLE SUPERHEATER,

LOWE WATER GAS APPARATUS.

Under Contract, 1899:

	SETS.	DAILY CAPACITY.
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Derby, Conn.	1	750,000 "
Lowell, Mass.	1	1,000,000 "
Doylestown, Pa.	1	50,000 "
Darby, Pa.	1	400,000 "
Adrian, Mich.	1	125,000 "
Concord, N. H.	1	400,000 "
Sioux City, Iowa	1	750,000 "
Standard Gas Light Co., New York	3	5,400,000 "
Peekskill, N. Y.	1	250,000 "
Westchester, N. Y.	1	250,000 "
Jersey City, N. J.	1	1,000,000 "
Stapleton, N. Y.	1	750,000 "
London, O.	1	125,000 "
Chicago, Ills.	2	3,600,000 "
Putnam, Conn.	1	125,000 "
Mansfield, O.	1	250,000 "
Plymouth, Pa.	1	125,000 "
Total	21	15,600,000 "
Previously built	294	187,100,000 "
Grand Total	315	202,700,000 "

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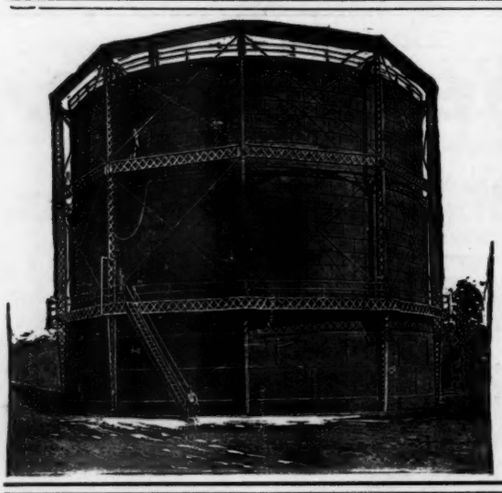

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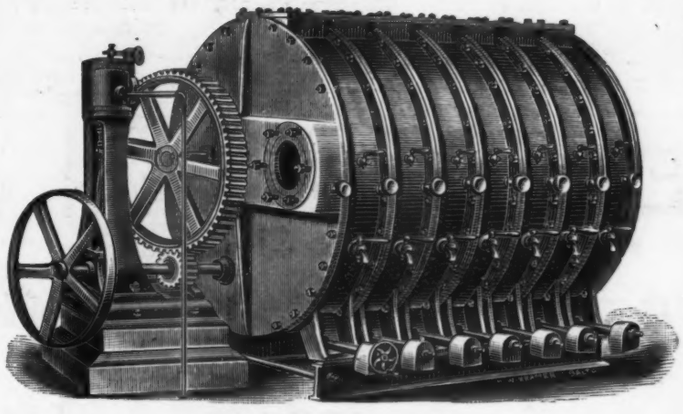

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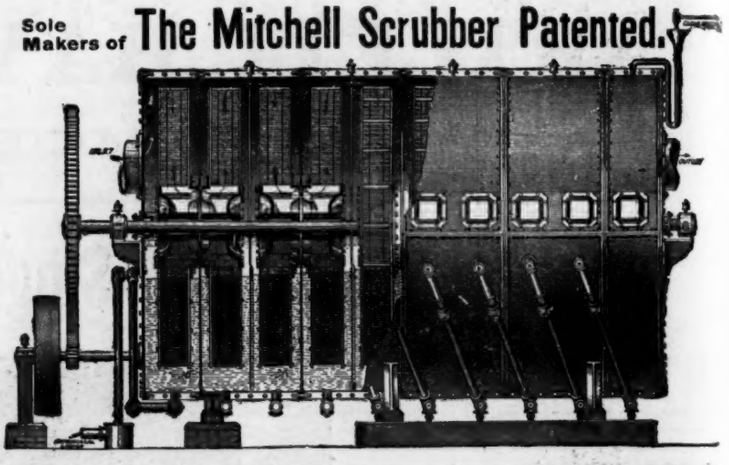

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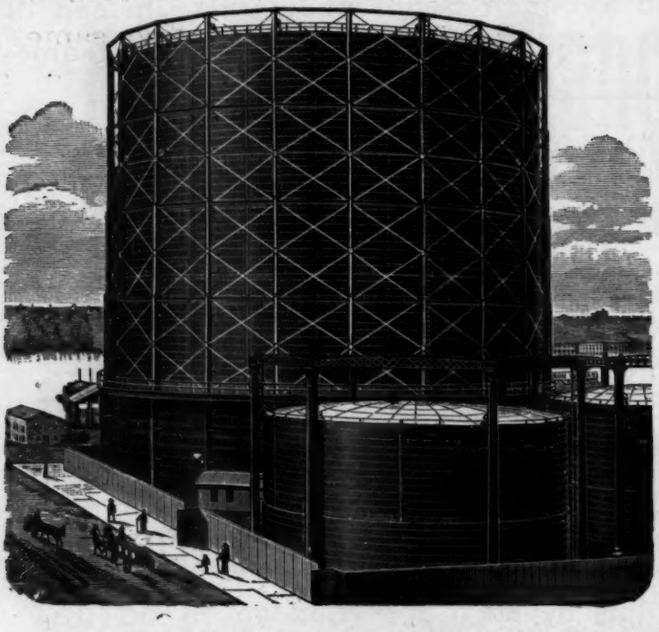

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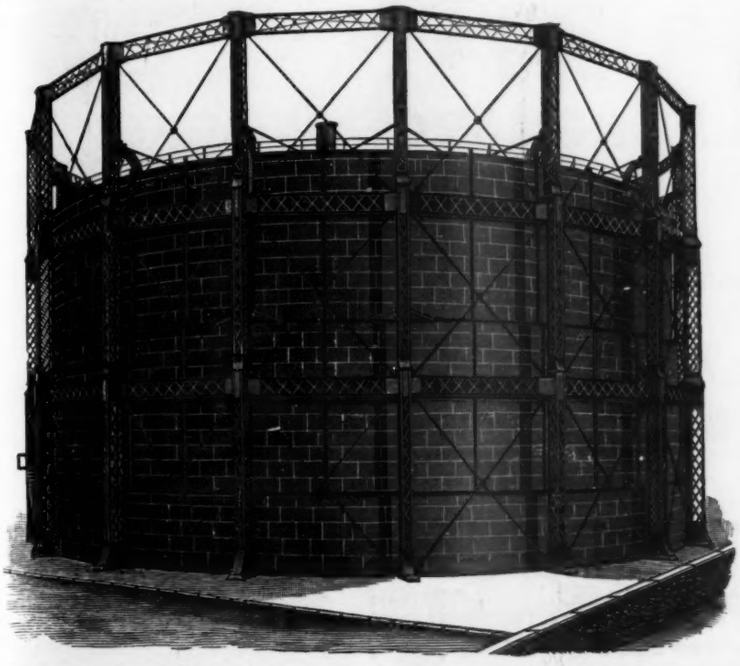

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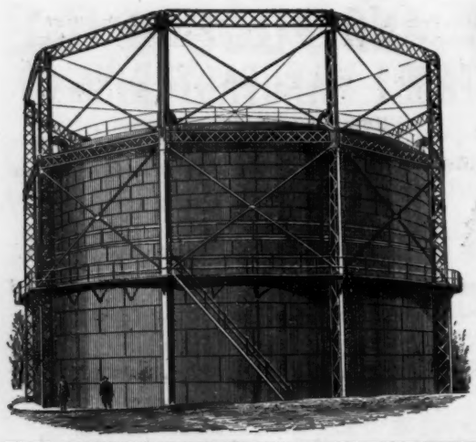

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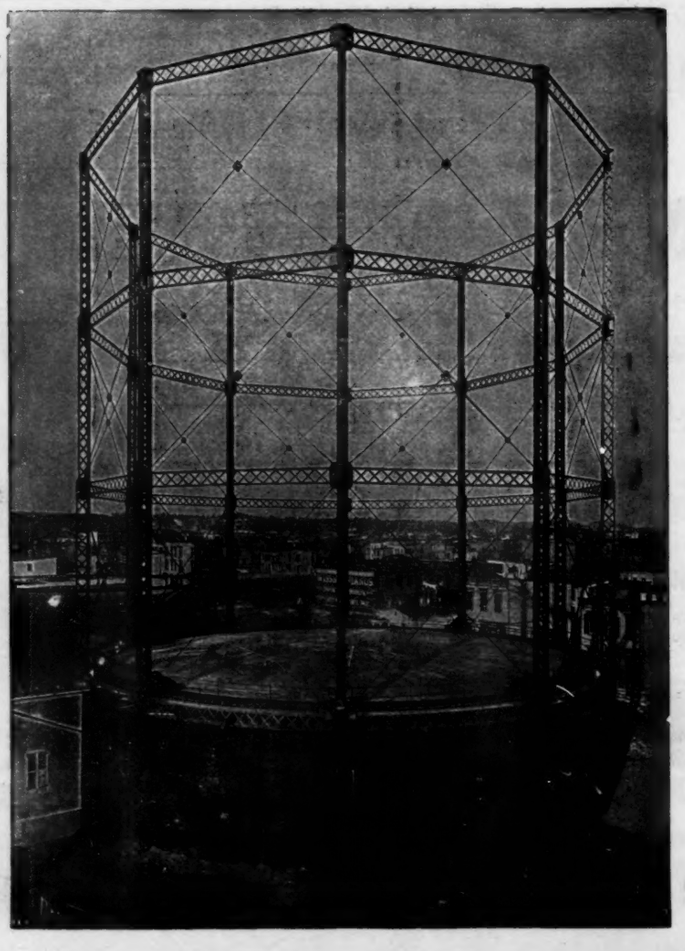

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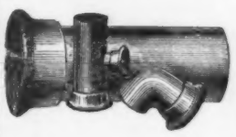

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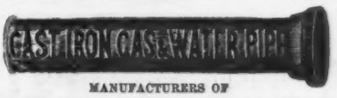

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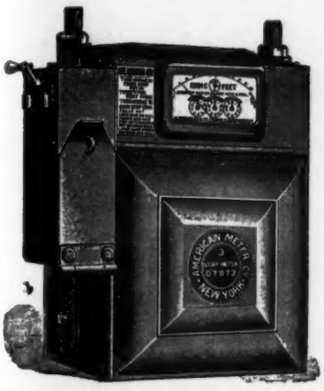

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